Nov.

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Science and Invention

THE HEALTH METER

See Page 590

IN THIS ISSUE $38,000.00 IN PRIZES

40 NON-TECHNICAL RADIO ARTICLES

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF

7 Tube Set
Single Dial Radio

30 DAYS FREE TRIAL

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Wonderful offer direct from the factory! The world's greatest radio.
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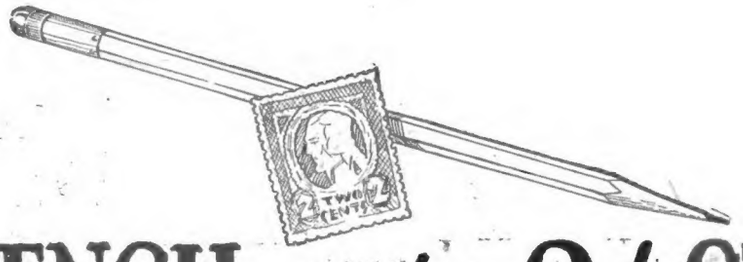

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Vol. XIV.
Whole No. 163

Science and Invention

FORMERLY

ELECTRICAL EXPERIMENTER

November, 1926
No. 7

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IN DECEMBER ISSUE

Paper Actors Movies' Latest

How inanimate actors were patiently manipulated through thousands of different positions to make latest movie thriller.

Cathode Rays In a New Role

The latest startling results obtained by Dr. W. D. Coolidge in his research laboratory at the famous General Electric works. Special illustrated interview by Mr. G. C. B. Rowe.

Muscle Reading—What Is It?

By means of this remarkable science it is possible to tell where a person has hidden an object. A system used by the greatest magicians. Don't miss this article.

Home-Made Wooden Toys

The "Home Mechanics" department will contain a practical how-to-make-it article by Mr. Butterfield, illustrated with easily understood drawings of toys and rockers.

How Movies Photograph Hurricanes

A timely article on a triumph of the photographer's art.

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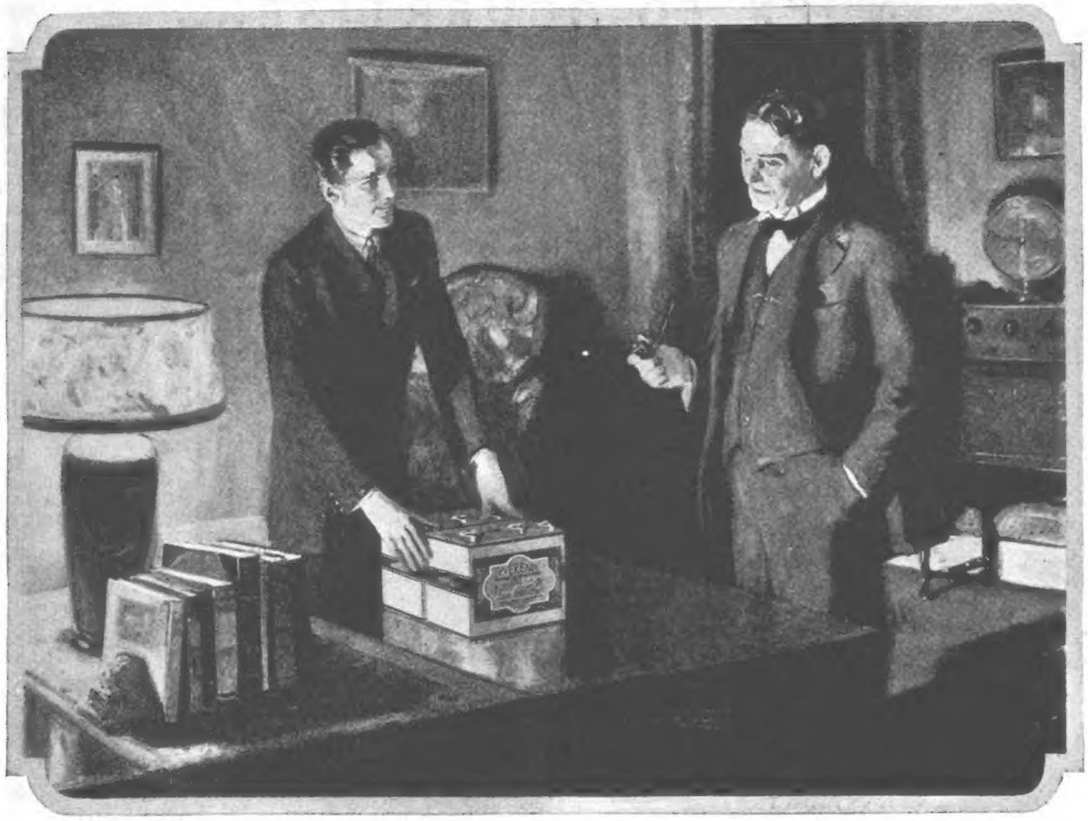

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LEFT—*Eveready Layerbilt No. 486.*

RIGHT—*No. 7111 Eveready Dry Cell Radio "A" Battery, 1½ volts.*

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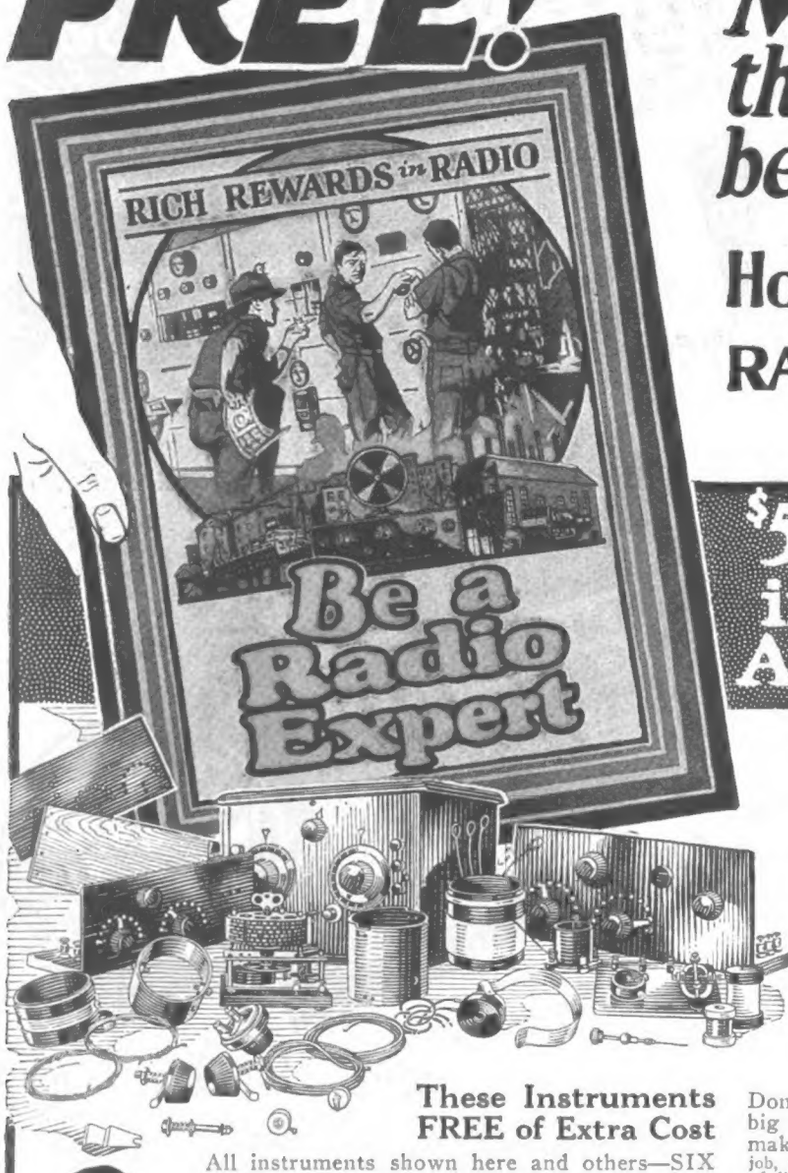

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J. E. SMITH
President

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Science and Invention

Nov., 1926
No. 7

HUGO GERNSBACK, *Editor-in-Chief*
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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

CAN WE REACH THE END OF KNOWLEDGE?

By HUGO GERNSBACK

IN the middle 50's of the last century, an examiner of the Patent Office resigned his position, because it was his firm belief that everything worthwhile had been invented, and it was useless to stay any longer in the Patent Office.

Here we have a man who, although he should by his training have known better, really believed that all worth while things had been invented, and that the world from that time on would offer no new surprises in invention. Since that time, the modern Telegraph, the Telephone, the Phonograph, Motion Pictures, X-rays, Radium, Radio, and thousands of other important inventions have come along. As a matter of fact, new inventions and new progress during the past 100 years are probably greater than during any period in the history of the human race for the past 10,000 years.

It is curious to note that the Man in the Street also very often gets the impression that the practical end of knowledge and scientific progress has been reached. He figures that it is impossible that much more inventing can be done, or, if there is such inventing, it is all to be in minor improvements. To his mind, all the really big things, as our ancient patent examiner thought, have been invented.

The truth of the matter is that as far as general knowledge is concerned we have not yet scratched the surface. The infinitesimal progress which we made during the past two centuries is as naught compared to what the world will see during the next 10,000 years. The fact which most people disregard is, that the discovery of any new principle, of any new fact, of any new theory, perhaps leading to one invention only at first, immediately mushrooms out into thousands of others. Every time one invention is made, it brings hundreds, and sometimes thousands of others in its wake. Every time we succeed in increasing, if only by 1/1000th of one per cent, the magnifying power of our microscopes and of our telescopes, literally millions of new worlds are laid bare on which new knowledge is gained. *And as yet we have really seen nothing.* We are still groping in the dark, and our minds are still extremely primitive.

When the ant stops in front of a small puddle of water, that, to his imagination, is, perhaps, a tremendously large ocean which can never be crossed. So it is with us in our present knowledge. We still look at all the really big things, as a dog might look at a complicated radio set. The dog can see the set and can hear the sounds. He knows that it is a physical object, but that is about all. Our present knowledge is very similar to the dog's knowledge just mentioned, when we look at almost any object around us.

You read, for instance, these very lines, and are totally ignorant of how the knowledge penetrates your consciousness. The very light reflected from this page into your eyes is a mystery to us. We know nothing about its inner workings. When you drop this magazine on the table, it falls by virtue of what we are pleased to call "gravity," but what this force is, how it acts, or how it can be controlled, we do not know.

There is hardly anything at all throughout the whole realm of nature that we know much about. We can only see the object, see or feel the effects of certain manifestations, but how they are produced, and of what they are constituted, we do not know, and may not know for a hundred thousand years. We look about the world and try to gain knowledge of many things, while the thing closest to us, our own bodies, is a matter of the greatest mystery. We do not understand the simplest processes that take place in our bodies, and although the art of doctoring is probably more than 10,000 years old, even today every doctor will admit that medicine, with few exceptions, is not an accurate science and involves many educated guesses.

I am not trying to find fault with medicine, but it is simply my desire to point out how little knowledge we have gained in 10,000 years, and what a tremendous amount of knowledge there is as yet to be gained. To be sure, we have dissected the human body. There is hardly a spot throughout the entire cross-section of the human body that has not been investigated by means of high power microscopes, but we still have only the vaguest notions as to what it is all about.

We shall probably never know much at all until we have found it possible to make visible the ultimate subdivisions of matter, which are now believed to be the Electron and the Proton; and many scientists today believe that we shall never be able to magnify matter to such an extent that we can see them. I am not convinced of this and I do believe that the time will come when it will be possible to see the revolving electrons, the same as we see the planets and the stars in the heavens today. It is possible that by that time not only millions, but literally billions of new facts will have been added to our knowledge, and at that time we shall really be able to say that we are starting from somewhere with a definite goal in view; whereas today we are still groping in an abyssmal dark and do not know what it is all about.

And when that time comes, it will then be really possible to branch out in earnest. Then we shall look upon our present knowledge as we of today look upon the workings of the mind of a savage, or the mind of a dog. All of which is a very good thing. If we of today were, for instance, given atomic power, we should probably either blow up the earth, or else annihilate each other in the lust of war and possession. These things will probably be locked away from us until we have progressed far enough in knowledge, so that such new powers will be handled by humanity with complete safety.

If we had atomic power today, we should no more know what to do with it than would a tribe of savages know how to handle nitroglycerine or dynamite. The results, in all likelihood, would be fatal to the savages, one way or another, because the savages would not know how to handle the nitro-glycerine for peaceful purposes, and if they did, the chances are that they would be killed accidentally.

It is the same with us today. Nature, in her wisdom, never makes jumps, and progresses normally, gradually, apparently painfully. Only by Herculean efforts of labor will humanity arise, slowly to a higher plane. History shows this conclusively, but even at the end of a hundred million years, if the human race should persist that long, will the end of knowledge not be reached. Figuratively speaking, the human race will be just as far from the end of knowledge then as we are now.

The next important thing to consider is the capacity of the human race to *absorb* knowledge. It is true that we of to-day have more knowledge than our forebears, who lived 10,000 years ago. On the other hand, much knowledge is lost through the ages, because it can no longer be used to advantage. What was of tremendous importance to the world of Caesar is of no use to us today, and consequently it is forgotten. *Knowledge is used progressively.*

A schoolboy of today knows infinitely more, in a way, than did Archimedes, but, on the other hand, Archimedes had a tremendous amount of the knowledge of his era.

The human mind is, after all, only a sponge. It can absorb just so much knowledge and no more. After that the excess leaks out and is forgotten.

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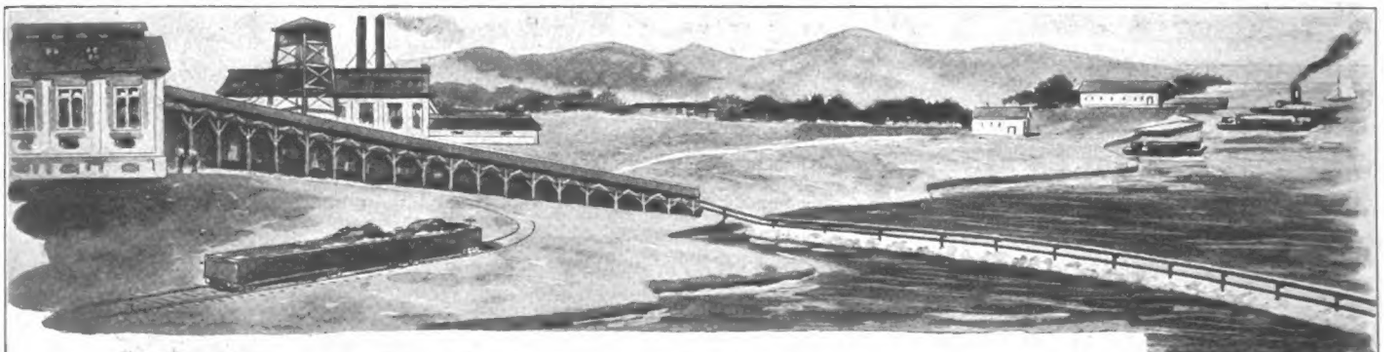
Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various scientific and radio subjects.

A Tidal Dam of Ice

HOW ICE DAM WILL RECLAIM VAST TERRITORY—DARING ENGINEERING FEAT



IN the United States the question of utilizing the latent water power of the ocean tides has taken great importance. Among the numerous plans which have been discussed, a German invention is extremely interesting and promises much for the future.

The idea represents a kind of freezing process by which a wall or dam of ice firmly connected to the bottom is created in rivers, lakes and seas, which, thanks to the strength of ice, can be used for tidal impounding. According to the plans of the inventor, a new province can be won on the German coast line for the Fatherland. The process serves also for improving the protection given by dykes against the flooding of the land, and is a useful adjunct in the building of hydraulic power plants.

The plans for utilizing the invention in Germany are already fairly well detailed. The new process is to be used in Lake Watten where for centuries land has been won from the North Sea, by erection of dykes and dams for the development of "polders" as in Holland, whose presence gives to the Schleswig-Holstein coast the characteristic appearance of a hedged-in landscape. The method used hitherto has been very expensive and slow in execution. It takes several decades before a tract of land of a few hundred meters is won from the

The illustration above shows power plant supplying liquid air to pipe lines as well as exhaust pipe system, to be used in forming an ice dam. While the ice dam is in place, a regular concrete dam is built inside the barrier so formed, the ice structure being allowed to melt away afterward.

AREA TO BE RECLAIMED
SOLID BOTTOM
SILT
PUMPING SILT INTO RECLAIMED BASIN
FLOATING STEAM PUMPS CARRY FERTILE SILT INTO RECLAIMED BASIN
PROTECTIVE ICE DAM

The picture above shows sea-covered land area being reclaimed, huge floating centrifugal pumps withdrawing the water impounded behind the ice dam. The ice is formed by pumping liquid air from the power station on shore through the long semicircular pipe line shown above.

Picture at right shows semisectional view of the new land reclamation scheme proposed by a German engineer, and which has actually been tried out. The concrete dam is seen inside the area walled off by the temporary ice dam and fertile silt is being pumped into the reclaimed basin.

sea. Constantly the operatives on the dyke who carry out this recovery of land and community improvements have a heavy burden. In following the new system, the winning of land will be quicker and easier, the years of work for building the dykes and dam, where storm-tides often enough destroy in a few minutes the work of months, will be done in a few days. The description of the new system follows:

Only a short while ago an invention was presented to a small circle of interested people, by which it was proposed within a few days to construct dams a kilometer long in the water and at low expense. The proposal was simply to freeze the water in a determined direction and of a definite width. This mass of ice freezes fast to the bottom, so that a solid wall of ice is produced. This is absolutely impermeable. To carry out this process, liquid air is fed into the water, partly through a system of pipes and in part is sprayed into the water from boats. According to the proposal of the inventor for carrying out the invention, such a system of pipes will be set up in a German inland lake. The pipes in part are laid upon the bottom of the sea; in part they are to rise to a proper height through the water, and in this way form a connection between two points of land three hundred meters apart. Within three hours after work begins on the production of liquid air, a wall of ice two to four meters high was produced that had a thickness on the bottom of two meters (over six feet) and which reaches from ten to fifteen centimeters (four to six inches) above the surface of the water. The commission was convinced that every claim indicated by the experiment was carried out and determined to organize a company to develop the invention. As a first practical attempt in the next few months a bay on the coast of the North Sea, in the vicinity of the city of Husum, is to be closed by a dam of twelve hundred meters (about 4,000 feet) long, and is then to be pumped out. Next the ice dam is to be replaced by a long wall of concrete where the attempt is to be made to avoid the expense of the elaborate false work and sheet piling of the area. Technicians believe that before the melting of the wall of ice, the ocean will carry so much sediment to the place, that in the locality of the mass of ice, before its melting, the ocean bed will rise steeply to the summit of the concrete wall, so that only a slight reinforcement by buttresses will be required. It is hoped that this dam can be made within fourteen days and only cost a third of the probable cost of the ordinary construction.

If the first practical application of this project is successful, many North Sea communities will be interested in putting Halligen into connection with the mainland. To carry out this work in small divisions about four years will be required. The territory reclaimed would about equal in size the lost provinces of Alsace and Lorraine, which would return the invested capital within a few years. All those who live near the locality where the first trials were made, have no doubts as to the carrying out of the plan. A few hours after the first experiment, the means for carrying out the first practical trial on the Baltic Sea were in hand, an indication of great progress in German finances. Naturally various technical and learned objections to the invention have been made public. Doubt for instance has been expressed if it would ever be possible to secure the wall of ice suffi-

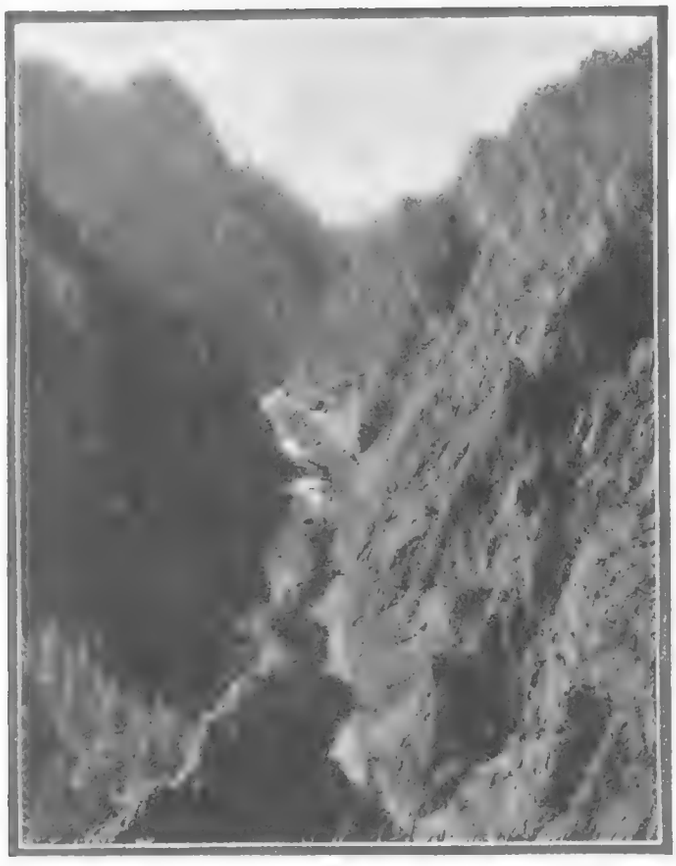
(*Continued on page* 665)

Here we see the newly recovered land with the concrete dam holding back the sea. The houses on the bluff in the foreground represent the only buildings that previously existed on dry land. Note the huge reclaimed area now under cultivation and also the old coastline at the left.

Our Longest Railroad Tunnel

The Longest Railroad Tunnel in America Will Be 6.1 Miles Long and Will Shorten Distance Between Denver and Salt Lake City 173 Miles.

By H. WINFIELD SECOR



The accompanying view at the left shows the kind of mountains through which the famous Moffatt Tunnel is being driven. At the center of the tunnel there is about one-half mile of rock above the bore.

When completed the Moffatt Tunnel will be the longest railroad tunnel on the American continent, being 6.1 miles long; the main bore will be for single track railroad, and is 16 feet wide by 24 feet high, as one of the accompanying sectional views shows. A so-called pioneer bore, which will eventually be used for a water tunnel to help supply the city of Denver with water, lies 75 feet south of the main railroad bore and it measures 8 by 9 feet. It runs parallel to the main bore and at regular intervals there are cross-cuts between the two tunnels, the pioneer or water tunnel being used to help remove water and in the building of the railroad tunnel. By the time the tunnels are finished, nine million feet of timbering will have been used. World's records in tunnel building are repeatedly being made on the Moffat Tunnel, so the engineers report, the best records so far having been 1583 feet of headings in thirty days. The average advance of the two tunnels per day has been 24 feet, as one of the accompanying illustrations shows.

A recent visitor to the Moffat Tunnel, in describing his visit into the tunnel said:

"You have now stepped over into the water tunnel. It may be well to explain that the other name for the water tunnel is the service tunnel. While the water is carried through this tunnel, this is also where the present transportation of men and tools and all the service work connected with building the tunnel takes place, so that in the regular tunnel there is nothing going on save the actual work of construction.

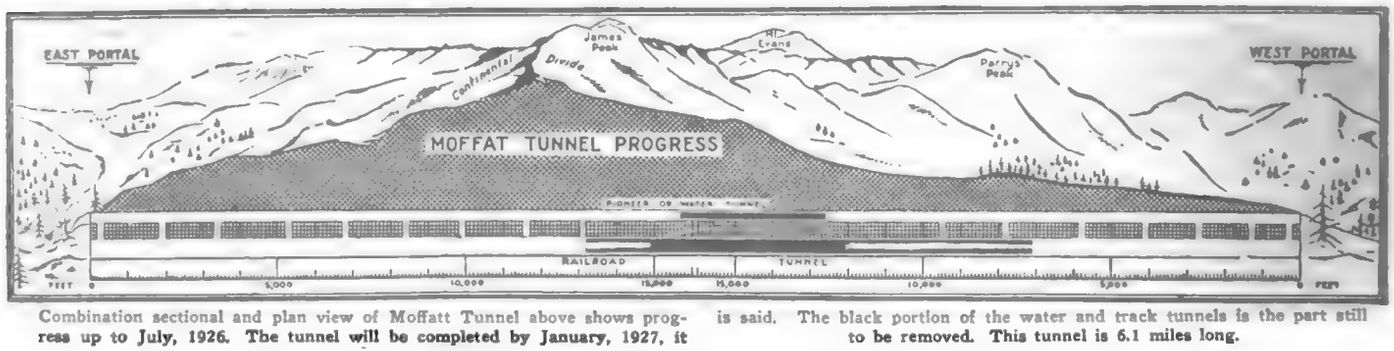
"Following along in the service tunnel, you are stepping off the track continually to let the trains go by; and, as they come along, you get the various orders shouted from man to man as they carry on the operating details of the work—you get the spirit and the rush of building this great tunnel.

"As you step back from the service tunnel through the next crosscut, you are attracted by the switch-box in the crosscut,

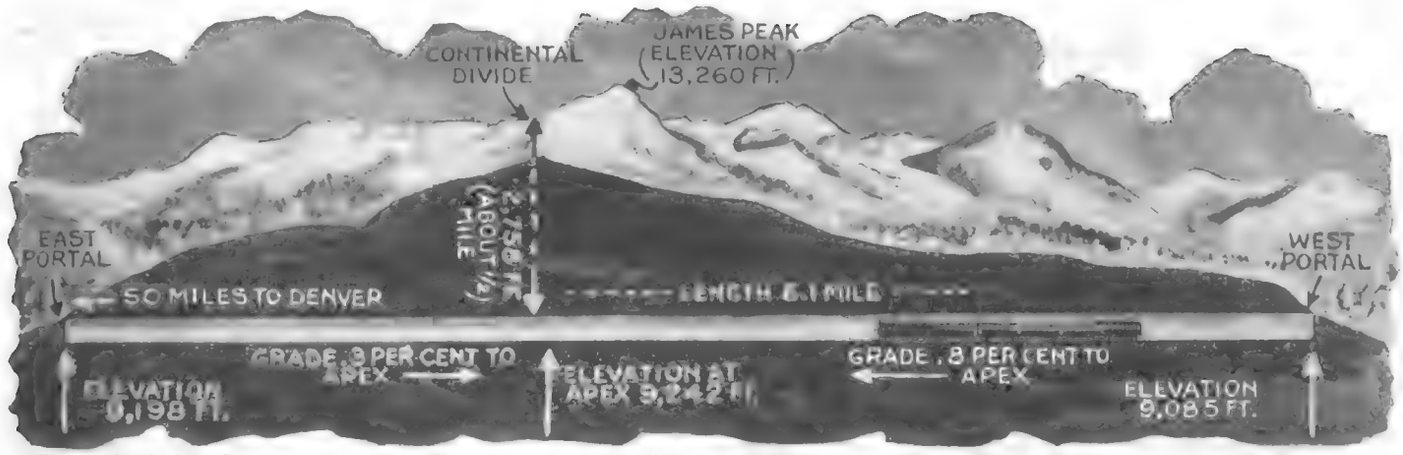
The picture above is an actual photograph taken inside the Moffatt Tunnel and shows how the blasted rock is carried out on cars running along tracks to the entrance.

The photo reproduced at left shows appearance of one of the portals of the Moffatt Tunnel in wintertime. The workers live in two towns situated at either portal.

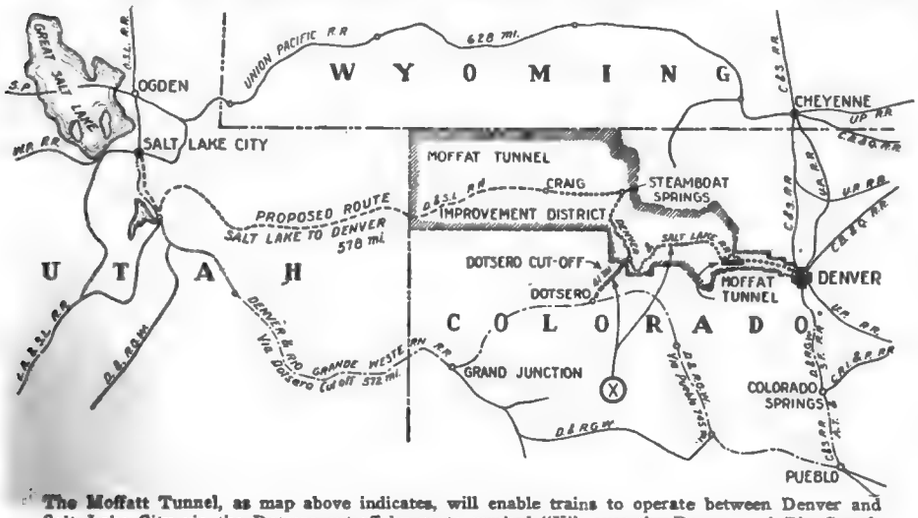
FOR a number of years one of the greatest railroad developments in the western United States has been the famous Moffat Tunnel project in the state of Colorado, the east portal of which is located approximately 50 miles west of the city of Denver. By looking at the accompanying map, those who are not familiar with the western railroad routes, will see that the optional routes heretofore have been to go either north to Cheyenne or else southward to Pueblo on the way to Salt Lake City, or from that city eastward to Denver. When the Moffat Tunnel is put into operation and trains operated over the 41 mile Dotsero cut-off, or else over the proposed extension of the Denver and Salt Lake Railroad, indicated by dotted lines on the map, the distance between Denver and Salt Lake City will be shortened by 173 miles of travel, equivalent to one-quarter day of traveling time. Not only this, but the terrific climb over the Corona Divide, comprising 30 miles of four per cent grade, will be eliminated.



Combination sectional and plan view of Moffatt Tunnel above shows progress up to July, 1926. The tunnel will be completed by January, 1927, it is said. The black portion of the water and track tunnels is the part still to be removed. This tunnel is 6.1 miles long.



The sectional view above shows the outstanding features of the Moffatt Tunnel which pierces the famous Continental Divide, the crest of which is 2758 feet above the track bore. The train is shown out of proportion of course, as also is the height of the tunnel.



The Moffatt Tunnel, as map above indicates, will enable trains to operate between Denver and Salt Lake City via the Dotsero cut-off by route marked "X", over the Denver and Rio Grande Western Railroad, saving 173 miles, equivalent to one-quarter day of traveling time.

carefully locked. Not a shot (dynamite) will be fired until the order has been given and until it is certain that there are no men ahead. Due to such strict precautions is the fact that during the entire work on the tunnel there have been but four fatal accidents.

"On the way back, you observe the perfect ventilating system that keeps the air continually fresh the entire length of the tunnel, and the dry clothes house, where men may change and shower before going out into the weather."

The construction of an 8 by 9 feet water tunnel, 75 feet to the south of the 16 by 24 feet standard, single track railroad bore and parallel with it, is peculiar to the Moffat Tunnel, although pioneer tunnels for transportation, ventilation pipes and wiring have been successfully used in Europe and Canada. The twin heading alternating system of driving, together with the machinery necessary to carry out this method, has also been first developed here. For the soft ground, the Lewis cantilever needlebar has solved the worst problems. Outside in the timber yard, a framing machine has been devised to save time and labor.

TWIN HEADING ALTERNATING SYSTEM

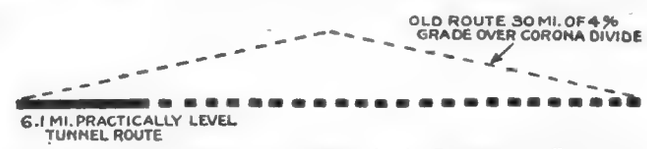
The Moffatt Tunnel is the first to apply the alternating system in the twin headings, a method enabling the same crew to drill both water tunnel and main heading in one shift, alternating with the mucking crew and thus, unhampered by each other, to do about twice the amount of work possible in a single heading. It is customary for each of the three eight-hour shifts to "pull" at least one complete round, which makes the average daily progress in each heading about 24 feet. Machinery has been adapted, or developed, on the job to obtain these results. A drill carriage on wheels and mounting four drills, with a manifold, which feeds air, oil and water to all four machines with but one connection to the supply lines, cuts the set up time from forty down to fifteen minutes and enables the drill crew to move their drifters from heading to heading through the nearest crosscut. An electric mucking machine, with belt conveyor, loads two cubic-yard cars in two minutes each, saving both time and cost over hand-mucking. An air-hoist car-switcher facilitates the moving of empty cars to the mucker. Above all, however, the alternating system has been perfected under the stimulus of a bonus to a point that has never before been reached.

THE WATER TUNNEL

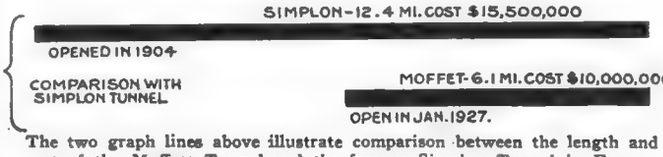
The water tunnel carries the 8-inch compressed air feeder pipes for the drills, sump pumps and air shovel, the 2,300 volt power line to the motor-generator sets near the heading, where the 250-volt D.C. circuit is turned out for the trolleys, muckers and blowers, the 110-volt lighting and firing circuits, the 3-inch water supply line and the 12-inch ventilating pipes, in addition to serving as an outlet for the narrow-gauge (24-inch) muck trains, hauled by storage battery and trolley locomotives from all headings.

In the hard rock at East Portal the water

(*Continued on page 657*)



Not only will the Moffatt Tunnel route, via the Dotsero cut-off, or over the proposed D. and S. L. Railroad, via Craig, save 173 miles of travel between Denver and Salt Lake City, but it will also eliminate the terrific climb of 30 miles of 4 per cent. grade over the Corona Divide.



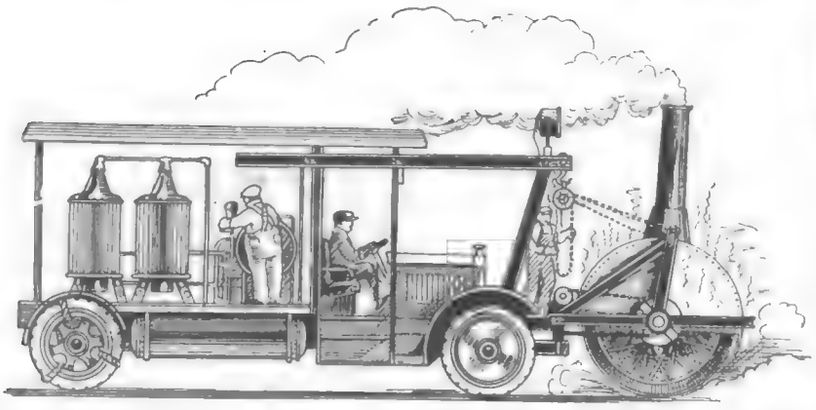
The two graph lines above illustrate comparison between the length and cost of the Moffatt Tunnel and the famous Simplon Tunnel in Europe.

The picture at the left shows the average daily advance in both the water tunnel and the track bore of the Moffatt Tunnel under the Continental Divide. The average daily advance amounts to 24 feet in both headings.

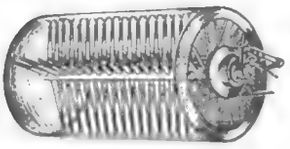
AVG. ADVANCE 24 FT. PER DAY
WATER TUNNEL
16 FT.
CONCRETE LINED
SOUTH
CROSS-CUTS USED IN CONSTRUCTION WORK
CONCRETE BULKHEAD
WATER TUNNEL TO SUPPLY DENVER (4 X 9 FT.)
WITH WATER 75 FT. SOUTH AND PARALLEL TO R.R BORE

Picture at right shows sectional view through both water and track tunnels Electric engines will probably be used to haul trains through the Moffatt Tunnel. Cross cuts between two bores will be blocked off after construction.

New Snow Removal Methods



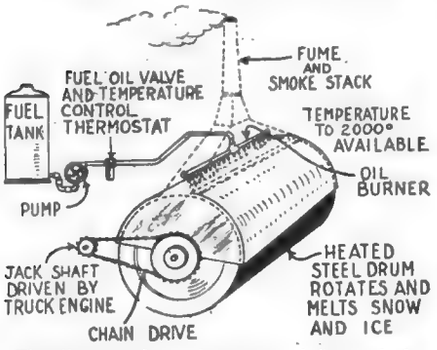
The illustration shows the new type of snow remover known as the Snow Converter, which has actually been built and which will remove one cubic yard of snow at a cost of $.20 compared with the present price of $1.65.



Oil passes to the inside of the cylinder through the shaft. A series of oil burners heat the drum which, rolling along the snow, melts it and converts it into water. The system is quite speedy and very cheap.

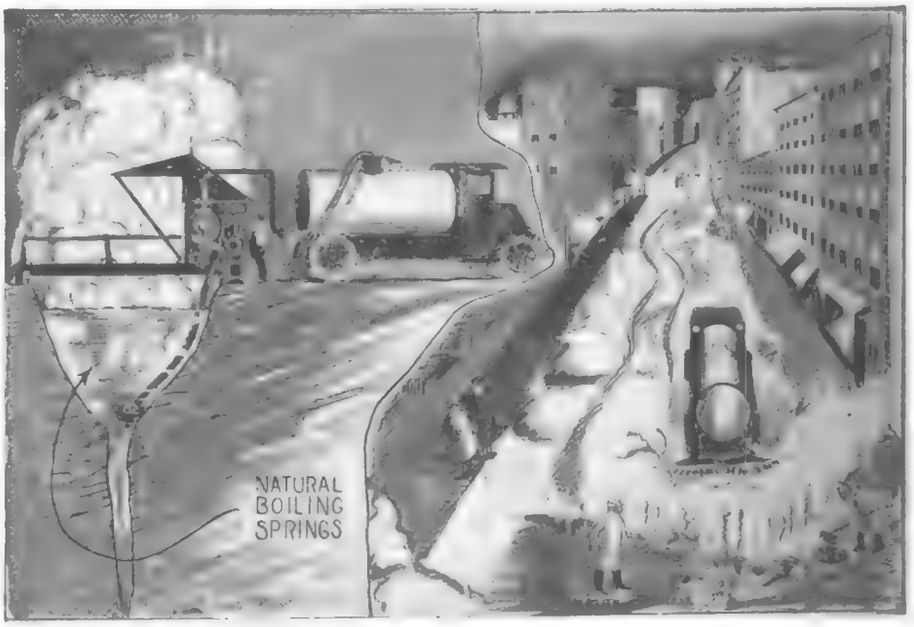
On this page are shown two of the most important methods of removing snow which have actually been employed during the winter months. The Snow Converter consists of a large automobile truck which has a heavy steel roller seven foot long, one and one-half inches thick and five feet in diameter attached to the front of the truck by means of suitable rigging. The drum is heated internally by a series of oil burners fed with oil from supply tanks on the truck. A temperature of 200 deg. Fahrenheit can be maintained if desired.

The illustration below shows how snow has been removed in Salt Lake City, Utah. In the days of warm weather the thought of snow makes us wish that winter were here again.


FUEL TANK
FUEL OIL VALVE AND TEMPERATURE CONTROL THERMOSTAT
FUME AND SMOKE STACK
TEMPERATURE TO 2000° AVAILABLE
OIL BURNER
PUMP
JACK SHAFT DRIVEN BY TRUCK ENGINE
CHAIN DRIVE
HEATED STEEL DRUM ROTATES AND MELTS SNOW AND ICE

The diagram above shows one of the methods of heating the gigantic roller which melts the snow coming in contact with it. The water runs into the sewerage system.

In Salt Lake City, Utah, snow has no terrors, for the City Departments. Water is taken from municipally owned boiling springs and by means of regular sprinkler trucks the hot water is sprayed upon the streets and the snow disappears as if by magic. Nature heats the springs to approximately 106 deg. Fahrenheit. The sprinkler trucks are equipped with high pressure pumps which eject the hot water. A cloud of steam rises and when it vanishes the snow seemingly goes with it, water alone being left.



World's Record Sun Dial

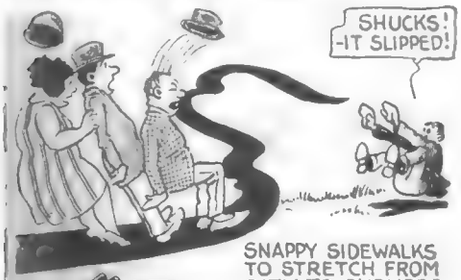
A pair of the world's largest sun dials tell the time for tourists at Dodge City, Kansas. In this city the change from central to mountain time is made. One of the sun dials gives central time and the other casts its shadows on mountain time. The thirty-foot dials are made of cobblestones painted white. Large Roman numerals designate the daylight hours. The dials are side by side in a park in the centre of the city and are visible by all railroad and automobile tourists. In this way they remind the tourists passing through the city to re-set their time-pieces.—Ralph C. Taylor.

Odd and Unusual Patents

By STUART WALKER

(Continued from September issue.)

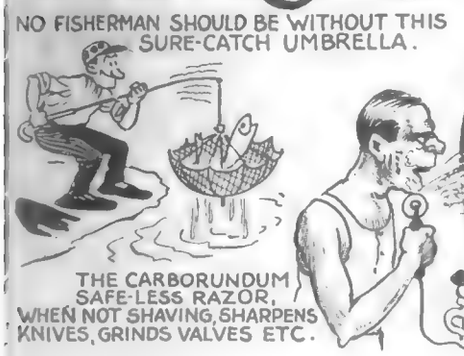
KEEP-KOOL-KELLY
FOR HOT-HEADED CITIZENS.



SNAPPY SIDEWALKS TO STRETCH FROM CITY TO SUBURBS

HARD ON YOUR NEIGHBORS CHICKENS BUT GOOD FOR YOUR GARDEN

FLY-CHASING BABY-CARRIAGE



NO FISHERMAN SHOULD BE WITHOUT THIS SURE-CATCH UMBRELLA.

AN enterprising gentleman from Buffalo had a beautiful scheme for solving the transportation problem. His invention covered an aerial railway which consisted of suspending cars from a cable extending between balloons stationed at pre-determined distances. A difference in the height of the balloon and an inclination of the cable between the balloons furnished the motive power for this extraordinary means of transportation. The inventor also provided high housetops to be used as stations. A pleasant word picture is painted in the patent telling of the delightful pleasure experienced in riding through the air in the suspended cable cars. And yet, in spite of this remarkable invention, the steam and electric roads continue to serve us.

Another curious patent covers what is called "a useful hat." This hat has two supports, one resting on each shoulder of the wearer, which hold the hat above the head. The inventor contends that this unique chapeau "will permit the free circulation of air around and over the head of the wearer, preventing headaches from the weight of the hat, and allowing free movement of the head independently of the hat."

The man surely must have been farm-raised who produced a combination churn and rocking chair. This device consists of a rocking chair having the churn in a small barrel attached beneath the seat of the chair. All that is necessary for my lady to do is to sit in the chair, read or knit and rock, and the distasteful task is taken care of.

A high sense of civic pride is apparent in the invention covering India rubber sidewalks. The pleasure of stopping, or bouncing, along a soft resilient sidewalk is evident, but there is also an economic slant to be considered. The inventor points out that such sidewalks might be stretched any desired length. This would also be an easy way to connect the city to the suburbs.

Whimsical may be used to describe a very quaint conception which was intended to keep chickens and other fowls from destroying gardens and flower beds by scratching. The inventor proposed to fasten long metal strips to the feet of the fowls. Beneath each strip was a shorter, strong, springy strip bent forward. According to the inventor, when the fowl attempted to scratch, the strong, springy strip would push it forward and the bird would involuntarily walk itself right out of the garden.

Although the subject matter is very serious, there is something amusing in the patent which covers a coffin equipped with a rope which extends to the surface of the

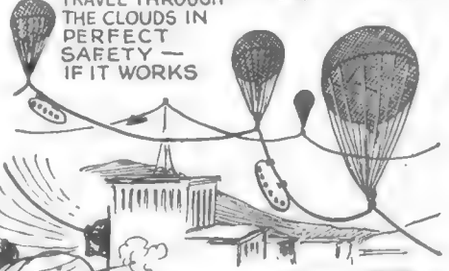
(*Continued on page* 652)

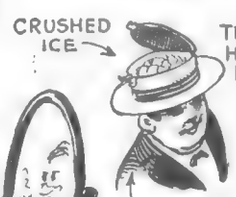
ALL THE COMFORTS OF THE SALON ON THE FARM.

YOU MAY BE DOWN BUT NEVER OUT AS LONG AS YOU CAN RING THE BELL.

THE STAY-AT-HOMES USING THIS ANCHORAGE ARE MISSING A GREAT DEAL OF EXCITEMENT AND THRILLS.

TRAVEL THROUGH THE CLOUDS IN PERFECT SAFETY — IF IT WORKS





THE REFRIGERATOR HAT KEEPS YOUR BRAINS FROM BECOMING SOFT

FOR SUMMER WEAR

FOR THE WINTER

THIS ATTRACTIVE NOSE MUFF PRESERVES THAT POPULAR "GLOW" SOLD IN RED, BLUE, GREEN ETC.

EVERY WELL REGULATED FAMILY SHOULD HAVE A MOTHER'S KNEE "RECTIFIER"

"SWAT THE AUDIENCE" IS THE MOTTO AT THIS MO

THE CARBORUNDUM SAFE-LESS RAZOR, WHEN NOT SHAVING, SHARPENS KNIVES, GRINDS VALVES ETC.

THE AUTOMATIC DOCTOR

By HUGO GERNSBACK

IN China, the doctor is paid to keep the patient well. He is not paid in case of sickness.

As progress goes on, we come to realize more and more that it is the *prevention* of diseases and of all the trouble that human flesh is heir to, and the warding off of diseases before they have made any inroad into the system, that is of the greatest value. Once a disease has started, it is difficult for even the best doctor to check it. Just as once a fire has gained headway, it is difficult to bring it under control.

Before a life insurance company takes a chance and gambles on your life, a doctor is sent to examine you, which examination, while superficial, indicates whether there is anything vitally wrong with your human machine. The tests that a life insurance doctor usually makes are the following:

He tests your heart to find out if it is sound. He tests your respiration, in order to ascertain that you have no lung or other respiratory diseases. He then tests your blood pressure in order to find out if your arteries are in good condition, and then he takes a sample of your urine, in order to determine whether your kidneys are in good condition. This examination, while it may appear incomplete, tells a whole world of facts about the human machine. If these four tests are anywhere near satisfactory, the life insurance company will take a chance on you, and you pass the test.

Curiously enough, very few people ever think of having themselves examined regularly, that is, let us say every six months, by a doctor, in order to find out whether their human machine is functioning normally. If they did, humanity would live a great deal longer. The trouble is we are usually too busy to go to a doctor, and then we suddenly find our human machine breaks down. We are puzzled and distressed, and often it is too late.

A good doctor can usually rectify many of our physical ills while they have still not progressed too far, but once they have made inroads into our system, it is often most difficult to check the disease.

We may in the near future see an automatic doctor, which does exactly the same work as is done by the life insurance doctor. A machine of this kind could easily be rented in most public places, swimming institutions, barber shops, and even in private homes. It would seem that our great corporations, always interested in keeping their employees in the best physical condition, would be interested in using such a machine. Such machines could be constructed at a relatively low cost, and I estimate that the cost of the machine need not exceed $300.00 in quantity production. Perhaps it could be made much more cheaply.

The machine would duplicate exactly the four tests made by the life insurance doctors, that is, tests of the heart, blood pressure, respiration, and urinalysis. The machine can be made in such a way that it can be operated by a layman, and by comparison of the charts, which the machine issues, he can see immediately whether his record is normal or abnormal. If not normal, he knows that a doctor should be seen immediately. If normal, he need not worry.

The illustration on Page 591 shows how the machine is actually used, and the illustration on this page shows the health chart, which is automatically delivered within a few minutes to the subject. These cards can be kept by the subject, and if dated and filed away, subsequent charts will give very interesting data on the functioning of the subject's health.

This is not a visionary scheme, as a machine of this kind can be built today by means which we already know, and it is my belief that sooner or later such machines will be used commercially.

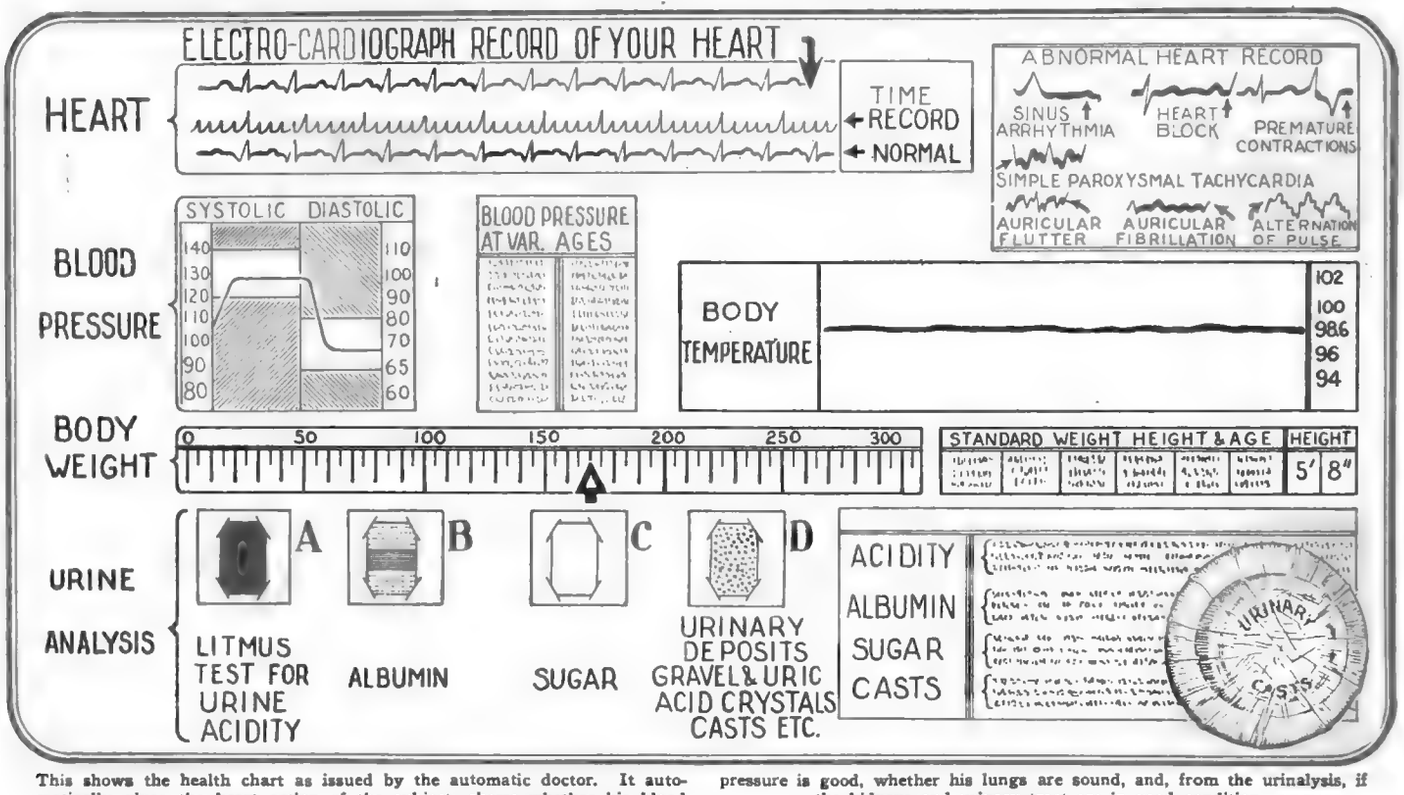
HOW THE MACHINE IS ACTUALLY USED

It will be noted from the illustration that at the very top of the machine there is an electro-cardiograph check which indicates whether or not the right or left hand of the patient is grasping the handles firmly enough. This instrument would undoubtedly be regulated by thermo-couples within the handles of the electro-cardiograph electrodes. At the left of the middle dial and slightly below it we have a "stage of test indicator." As soon as the instrument has completed one test, the needle of the instrument jumps to the next position, and thus in this way tells the patient to inhale or exhale, or to insert the bottle of urine in the urinary container, as the case may be. The dial at the right is a body temperature indicator, which not only gives him a visual representation of his temperature, taken at the hands or at the arm, but also has located behind it a correction factor for these points of the body. It is known that the rectal temperature differs from the axillary and mouth temperatures; consequently, the correction factor must be employed. The extension at and immediately below the center dial has an aspirometer affixed to its distal or free end. This will give the capacity of the lungs when the patient inhales and exhales.

A blood pressure meter will be found immediately below this with instructions for the use of the complete instrument at either side thereof. The blood pressure meter tells the pressure in the blood vessels in two ways; first, it will give the systolic pressure, normal 120 to 140, and by turning the left handle of the electro-cardiograph, it will give the diastolic pressure, normal 65 to 80. The graph in front of the patient is an enlarged view of the electro-cardiograph which is also recorded on the health report card. The weight of the patient will also be recorded, and the height is to be registered in back of the machine when the patient walks around to the back of the instrument and stands with his back against the same.

The patient's urine is deposited in a small receptacle at the side of the instrument, and it is distributed into four test tubes which are previously automatically prepared with litmus solution, nitric acid, Fehling's solution, and the last test tube is for the microscopic examination and detection of any

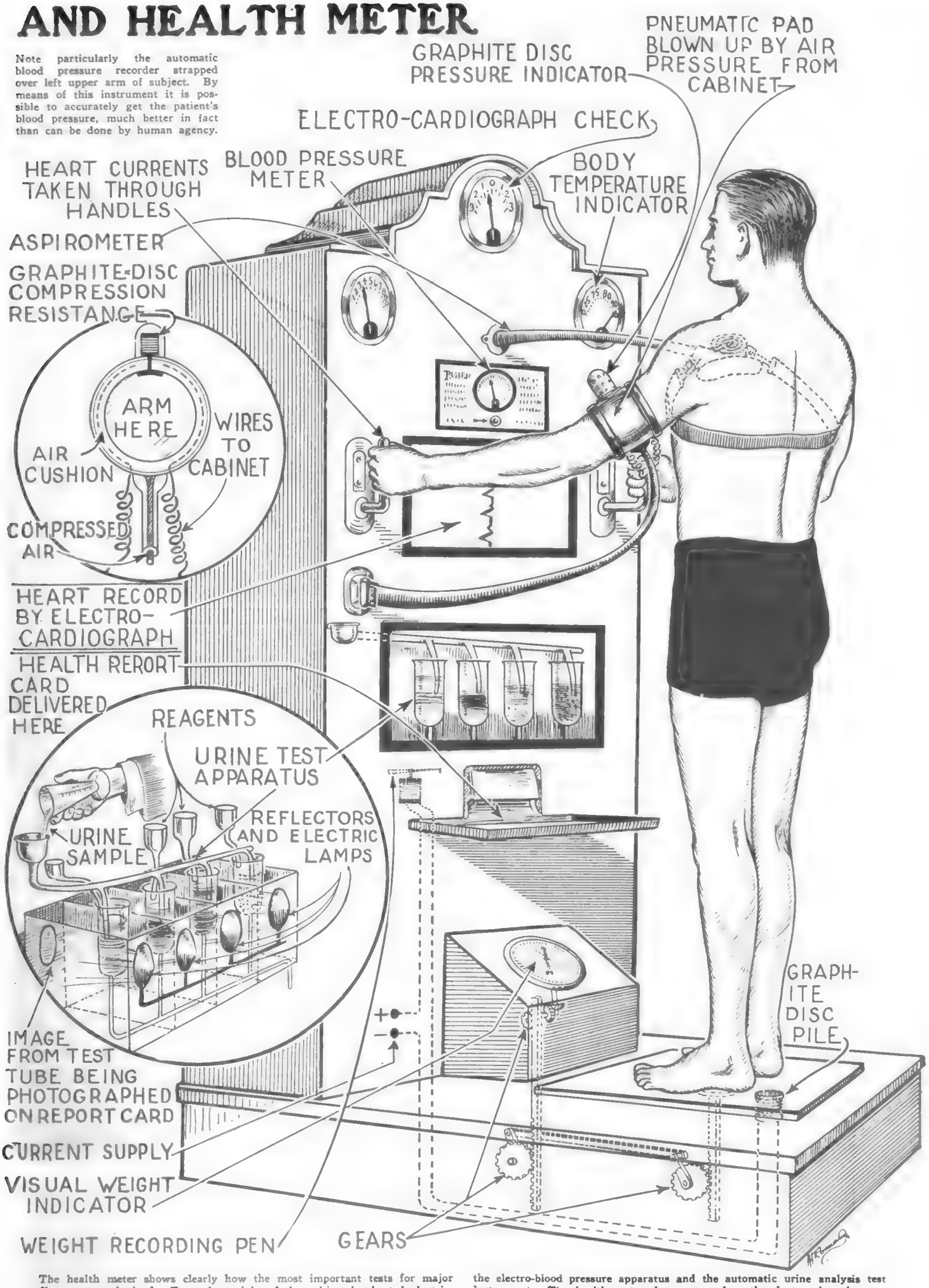
(*Continued on page* 663)



This shows the health chart as issued by the automatic doctor. It automatically gives the heart action of the subject, shows whether his blood pressure is good, whether his lungs are sound, and, from the urinalysis, if the kidneys and urinary tract are in good condition.

AND HEALTH METER

Note particularly the automatic blood pressure recorder strapped over left upper arm of subject. By means of this instrument it is possible to accurately get the patient's blood pressure, much better in fact than can be done by human agency.



The health meter shows clearly how the most important tests for major diseases are obtained. Even the weight of the subject is charted electrically by the graphite disc pile (rheostat). The inserts show construction of the electro-blood pressure apparatus and the automatic urine analysis test instrument. The health meter does not replace the doctor—it only supplements him and helps to ward off disease and sickness.

The Window-Garden in Winter

By DR. ERNEST BADE

THE rhythmic passing of the seasons is more clearly observed in plants than in animals. But behind the apparent deep and general rest of plant-life in winter, a mysterious unrest prevails. The sleep is not always as sound as it appears, some may be easily awakened to new life while others resist all attempts in this direction. Not only the apparent outward conditions such as the presence or lack of moisture in a form suitable for absorbtion as well as heat, have their effect upon the rest or growing stage of a plant, but other factors exert their influence also upon the vegetation. All plants must pass through a resting stage and when conditions are again favorable for growth, a new vigor passes through them. The natural resting stage is passed sometime during the first of December, and at this period plants may be forced. But during the months of October and November all attempts in this direction fail to bring a plant back to growth. It is, of course, quite natural that the resting stage of a plant in the open is prolonged, not because the plant cannot begin its growth under suitable conditions, but because climatic factors enter and force the plant to await moderate temperatures. The former case, where the plant passes through a comparatively short period of rest, depends upon an inherent characteristic of the plant which is passed on to other plant generations.

Chinese sacred lily, also known as "Joss flower" and by the Chinese name of "Shui Sin Far."

A close-up of the blooms of the Chinese sacred lily, about three-quarters natural size.

At present quite a number of methods are known whereby the period of rest required by a plant may be broken, or, at least, shortened considerably. Such processes require the aid of ether, warm baths preceeded by exposure to low temperatures, sudden changes in temperature and moisture content of the atmosphere, by means of light and exposure to radiant rays, etc. Here the internal processes of life taking place within the plant are accelerated with the result that the resting stage of a plant is considerably shortened.

All these methods are beyond all but professionals, and therefore those types of plants must be selected for the window garden, which have passed their natural period of rest early in the winter and which, when placed in favorable locations, will develop and produce the flowers whose buds have been formed the preceding season. Of this class the bulbs are the most important. Some of them are so tolerant that they will begin their growth early in the fall when placed in a bowl of gravel containing water, provided the bulb is placed near a window where it will receive plenty of light and sufficient warmth. It is in this way that *Narcissus orientalis* is commonly forced. It produces a bulb which is comparatively large, and the largest of these are to be preferred for they develop more leaves and flowers than smaller forms.

It is quite easy to cultivate them. They are simply placed in a bowl which is not too small, the bottom is first covered with pebbles and on these the bulb is placed and a number of pebbles are placed about the bulb to prevent it from falling over when the shafts are developed. Water is then poured into the bowl, and enough of it should be added to cover the bulb about half way. Water which evaporates or is used up by the plant during its growth, should be replaced. This prepared bulb is now placed in some dark and cool spot for a few weeks so that the roots may develop. At the time the roots begin to grow, the shoot awakens, and when it has attained a sufficient height, the bowl is placed near the light where growth is rapid at a temperature of 65 degrees F. When the flowers make their appearance the plant is susceptible to draft and changes of temperature and it should be protected as much as possible from these two important factors.

As a rule the plant will produce its flowers about eight weeks after it has been placed in the bowl. This bulb may also be potted just like tulips and hyacinth and such a procedure often gives a better and more uniform floral development. Then, too, when cultivated in water, the bulb is ruined and cannot be used again with any degree of success, for all available plant materials have been expended in the formation of the flowers, but when kept in a pot, the bulb is cared for until the leaves die back to the ground. Then, in this latter case, the bulb is stored in some cool spot throughout the summer, planted again in the fall, and brought to flower during the winter months.

The Chinese know this plant as "Joss" or the Holy Lily and it is also known as "Shui Sin Far". It is made to flower at the time of their New Year in February.

The paper white narcissus, *Narcissus papyraceus*, is cultivated in a similar manner. It produces an entire bouquet of white flowers which exhale a delicate perfume. Yellow flowered forms of this bulb are also known. A number of the bulbs are planted together in one pot or, when cultivated over water, a number of them are placed into a bowl containing pebbles. This type is treated just as *Narcissus orientalis*, with one difference, and that is that this form is not quite so rugged as the former plant. When potted, bulbs are kept in the cool dark place during the winter and only one or two of the pots placed near the window every two weeks, then flowers will be had throughout the entire winter.

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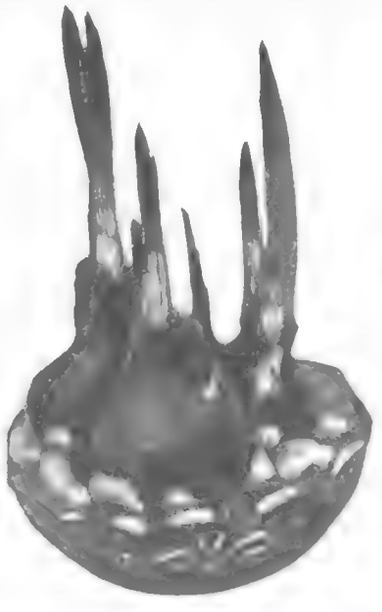


At left, the bulbs of the paper-white narcissus, which is one of the most beautiful of the winter-blooming flowers. Center, the flower in full bloom, showing the erect, graceful stems and parchment-like flowers. Above, the lovely bouquet of delicate white flowers, exhaling a delightful perfume, which characterizes the paper-white narcissus. This photograph is about two-thirds natural size.

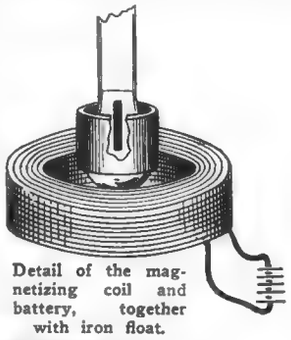
The Solidification of Helium

Process Described by Man Who Did It

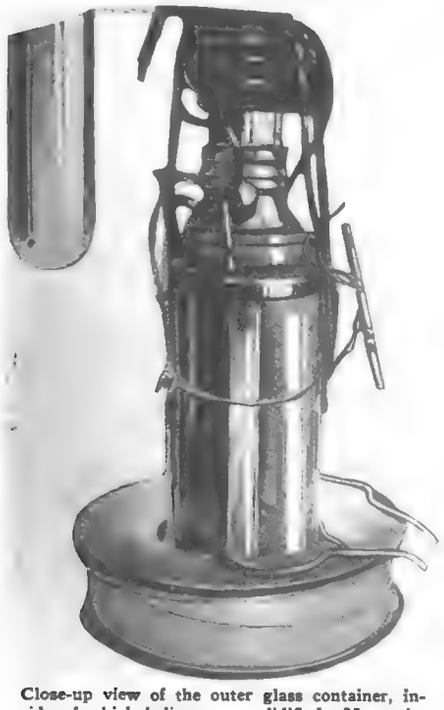
Prof. W. H. KEESOM, University of Leyden, Holland

PROF. KAMERLINGH-ONNES founded the Cryogenic Laboratory of the University of Leyden. At his lamented death within very recent years his work was continued by his successor, Prof. W. H. Keesom. Perhaps Prof. Onnes' latest great achievement was the liquefaction of helium, but it is only within a few weeks that the liquid was solidified. The first experiment took place on June 25 when proofs of the liquefaction were obtained, although as it was contained in a metal tube, nothing could be seen. Then a few days later on July 1, it was liquefied within a glass tube and an indirect proof of its solidification was obtained as will be described below.

In reading about the liquefaction of this gas, and of its solidification within so recent a time, it is pathetic to think of Faraday's early experiments in liquefaction of gases and to contrast his apparatus with the elaborate plant of such a laboratory as the one illustrated here. Faraday liquefied gases by placing a solid compound, which would evolve the gas on heating, in one end of a small bent glass tube hermetically sealed. On heating the solid chemical, the gas was evolved and produced such a high pressure that various gases were thus liquefied. It is told that in some of his experiments a visitor to the laboratory told him to keep oil out of his apparatus, criticizing him as being careless. We can imagine Faraday's quiet satisfaction in writing a note to the critic the next day saying that the oily substance which he noted in the apparatus was liquid chlorine.



Detail of the magnetizing coil and battery, together with iron float.



Close-up view of the outer glass container, inside of which helium was solidified. Magnetizing coil was used in determining when iron float in helium could not rise.

Many gases resisted liquefaction for so many years that it was considered impossible to reduce them to the liquid state, much less of course to the solid state, and these received the name of permanent gases. The name now has disappeared from scientific terminology as there are no permanent gases.

Although not directly connected with the subject of this article which has been kindly given us by Prof. Keesom, one of Prof. Kamerlingh-Onnes' great achievements had to do with the reduction of electrical resistance by extreme cold. He succeeded in reducing the resistance of a lead conductor to such an extent that if made continuous or circular, and if a current was started through it, the current would continue passing, presumably if it has been at the absolute zero it would pass forever. Now we know that an electric current attracts another one and the Amperean theory of magnetism pictures the magnet as containing a number of these little circular currents perhaps almost of the molecular diameter filling up the mass of the iron. By having the Onnes' current circulating in a lead conductor at absolute zero we would then have a permanent magnet without iron.

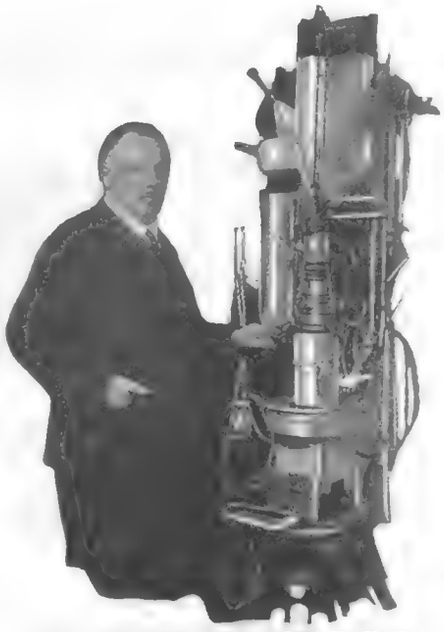


Photo reproduced above shows Prof. W. H. Keesom of the University of Leyden, Holland, and the apparatus in which he solidified helium. Arrow points to the glass jar in which helium was finally solidified.

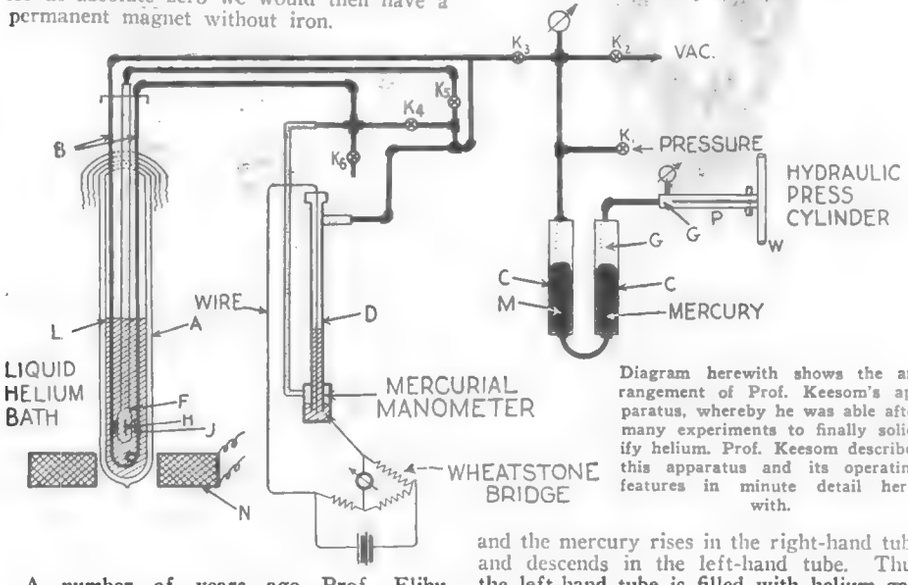


Diagram herewith shows the arrangement of Prof. Keesom's apparatus, whereby he was able after many experiments to finally solidify helium. Prof. Keesom describes this apparatus and its operating features in minute detail herewith.

A number of years ago Prof. Elihu Thompson suggested the enclosing of electrical lines in a circuit which was to be kept filled with liquid air in order to reduce resistance and economize copper or other metal used to carry the current.

HOW I SOLIDIFIED HELIUM

By Prof. W. H. Keesom

HELIUM has been solidified by simultaneously cooling it to the temperature obtainable by refrigeration with liquid helium and exposing it to a pressure of from 25 to 140 atmospheres, dependent on the temperature.

In the accompanying diagram A is the Dewar double walled vacuum vessel into which liquid helium is siphoned over from the helium liquefier, which has not been drawn. Of course the Dewar vessel is hermetically closed; it is surrounded by a concentric Dewar vessel filled with liquid hydrogen, this again by a third such vessel filled with liquid air.

B is a brass U-tube in which the helium to be solidified is compressed. To do this the wheel, W, of the hydraulic press, P, filled with glycerine, G, is first turned back. CC are two strong steel tubes, their bases connected by a smaller tube, and half filled with mercury, M. On turning the wheel, W, back, glycerine, G, enters the cylinder and the mercury rises in the right-hand tube and descends in the left-hand tube. Thus the left-hand tube is filled with helium gas, which enters through the stopcock K1 (K2 and K3 being closed). Then K1 is closed, K3 and K4 are opened, K5 and K6 are closed. By now turning the wheel of the hydraulic pump to the right the helium gas is compressed in the tube B. Here it is first liquefied and collects in the lower part of the tube, as high as the level L of the helium bath. When the pressure gets high enough it is solidified.

To detect whether the helium is solid as it is inside a metal tube, the following arrangement was used. D acts as a differential manometer. It consists of a steel tube entering into the mercury chamber, E. The stopcock, K4 being closed, K3 open and K1 closed, K2 is opened for a moment, and the tube B is blocked by a piece of solid helium, so that there is a difference of pressure between the two sides of B, and the pressure within D becomes less than the pressure on the mercury in E and the mercury rises in D. Now along the axis of D is stretched a thin platinum wire, which forms one of the branches of a Wheatstone bridge arrangement. When the mercury rises in D, the resistance of this branch diminishes and the pointer of the galvanometer is deflected.

(*Continued on page* 665)

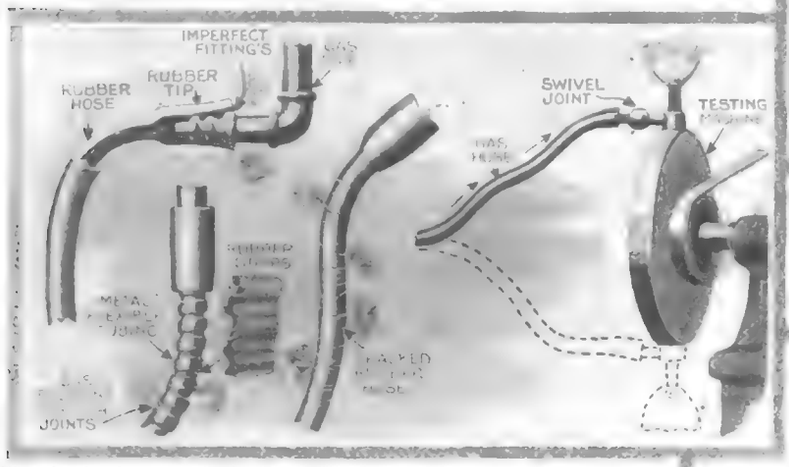
The Month's Scientific News Illustrated

By GEORGE WALL

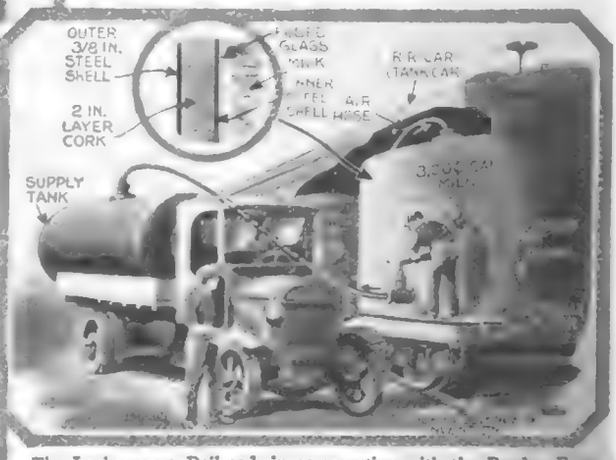
A tunnel 5 miles long, connecting the huge lake called the Etang de Berre near Marseilles with the Mediterranean, and capable of carrying vessels of 1200 tons, was recently finished. This marvelous piece of engineering creates a direct route from Marseilles to Central Europe through the Rhone and Rhine Canals, cutting off many extra miles of travel.

An old time fiddler of Portland, Ore., is using a fiddle made from a beer keg to furnish music for square dances. The instrument is about the size of a 'cello, and has a tone-quality and range similar to it.

Tests conducted at the University of Michigan show that athletes average higher grades in their class-room standings than non-athletes. The varsity men stand highest, second string men only slightly lower.



The rise in the number of deaths due to faulty flexible gas-piping has forced the Board of Health of New York City to enact stringent regulations concerning tubing furnished for home installation. Apparatus has been developed to test the hose under tension, compression and torsion. Another dangerous detail in installing gas fittings lies in the fact that the connection between the rubber tip and the burner fitting may be loose or leaky so as to release gas in small quantities.



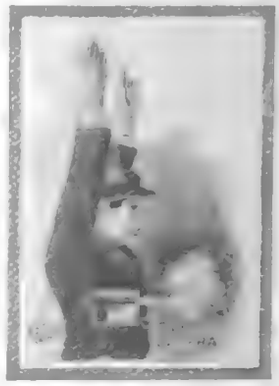
The Lackawanna Railroad, in co-operation with the Borden Farm Products Co., recently inaugurated a new method of bringing milk to New York City. Milk kept in two 3000-gallon vacuum tanks changed little in temperature, during a trip of 252 miles in 13 hours, rising from 38° F. to 39° F.

Customs officers near Newport, Vt., found themselves thrown off guard by a smoke screen when they were pursuing a bootlegger across the border. The car was equipped to produce an oil-spray smoke screen.

THE crew of the Coast Guard destroyer "McDougal" discovered a new ruse of rum runners when they captured a Canadian blockade runner off Montauk Point, L. I. Torpedo-shaped steel tubes, each fitted with air chamber to keep it afloat slightly under the surface of the water, were used to smuggle Scotch malt through under the eyes of the Coast Guards. The tubes are 16 feet long and painted a gray-green and are quite invisible in the water. The tubes are towed by a power boat.

It looks as if the rum-runners are becoming more ingenious every day. We expect to hear soon that they have adopted full-fledged submarines.

If a bandit says "Hands up!" to this man, the victim is only too glad to reply, for the motion of his arms as he raises them fires the pistol hidden in the fake camera cover buckled at his side.



A German inventor has recently evolved this device to discourage would-be highwaymen.

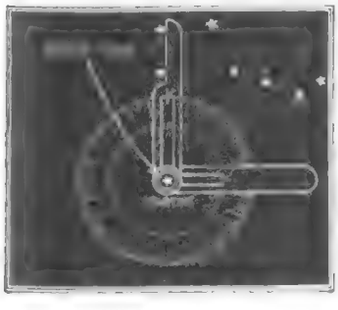
Twentieth Century Suicide

A DESPATCH from Trieste, Italy, reports that the first suicide by electrocution in the history of Italy plunged the city into darkness a short time ago. The fusing of wires in the Orcina power house led to the despatching of a search party, which found charred bodies of an electrician and a nineteen-year-old girl nearby. The death pact, attributed to an unhappy love affair was carefully carried out. Wrapping yards of electric wire around himself and the girl, the man tied to the end of the wire about 30 yards of cord with a heavy stone attached and then threw the stone, bringing the suicide apparatus in contact with the heavily charged wire. This report is reminiscent of an article written by Mr. Hugo Gernsback in the August, 1923, issue of this magazine, which tells of an electric duel fought by two young Italians to decide which should be the lucky suitor for the hand of one of the belles of Milan. One side of the line was grounded, the other wrapped around their waists and they fought to push each other off an insulated platform to certain death.

A double suicide by electricity was chosen by two young Italian victims in preference to separation. A conductor was wound about their waists, and the end was thrown over a highly charged transmission line.

Telling Time by Stars

The smallest "star time clock" illustrated above may be used to tell time very accurately by reference to the North Star.

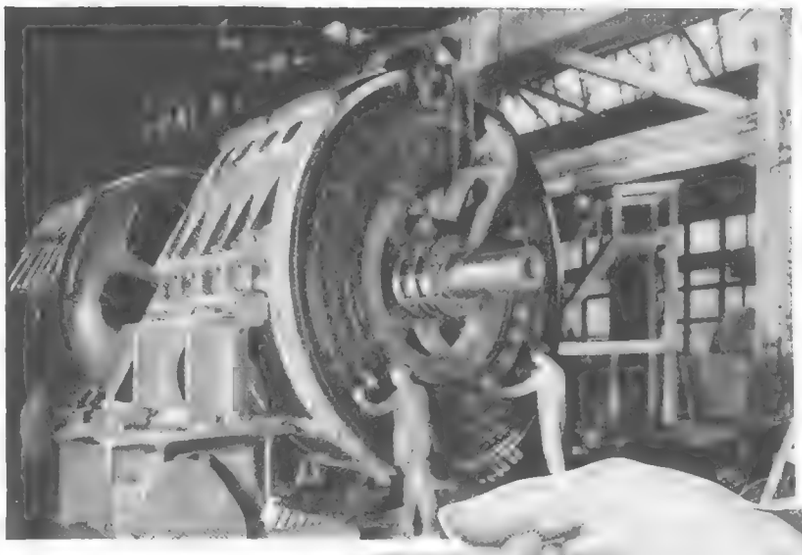


At left is seen a method of using the "star time clock." Two stars of the Big Dipper are lined up with one arm.

THE Big Dipper, as almost everyone knows, moves around the North Star with the two stars which form the outer edge of the bowl always pointing at the pole star. And any amateur astronomer will tell you that the great familiar group makes its circuit once in every 23 hours and 56 minutes. If you take the two edge stars already referred to as the hour hand of a clock whose center is the pole star, you can visualize a heavenly instrument which has only one hand and which gains four minutes on the clock every day. Gaining four minutes each day, the hour hand tonight at 9 o'clock will be found on the opposite side of the face from where it stood at 9 o'clock six months ago. By taking the date into consideration, this difference is allowed for by the new instrument shown above. As may be seen, the Startime "Watch" is held with the date arm straight downward, the North Star is sighted through the center hole, and the time arm is moved around the circle until the two edge stars of the Dipper are lined up.

Contrast In Motors

WHAT is believed to be one of the smallest practical motors ever manufactured is used by the General Electric Company in certain types of demand meters. The motor has a power output of approximately one-quarter of one millionth part of one horsepower. It is two inches high and weighs only four ounces. The rotor is a thin disk, one and one-half inches in diameter. In contrast with this tiny motor is the great motor shown, rated at 22,500 horsepower. This motor, which is used in the transmission system of electric drive battleships, is over fifteen feet in diameter, and has a total weight of 220,000 pounds.



The giant electric motor at the left is part of the power plant of one of Uncle Sam's new super-dreadnaughts. It is rated at more than 22,000 horsepower, and an idea of its size may be gained by comparison with the workmen beside it.

At the right is one of the smallest motors ever made. It is designed to be used in current meters, and absorbs ony a tiny fraction of one horsepower. Naturally a motor of this size is limited in utility, and its chief interest to most people lies in the novelty of its extreme diminutiveness.

The Astrology Humbug

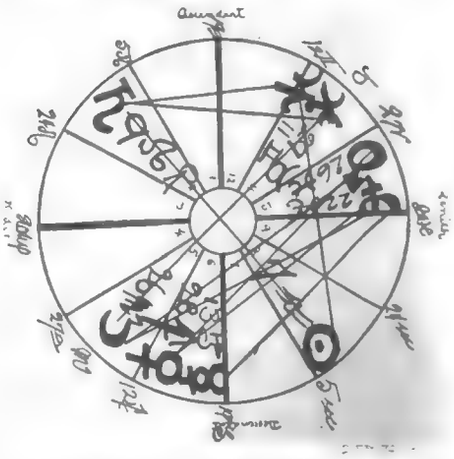
By JOSEPH H. KRAUS

Ex-Kaiser Wilhelm, whose horoscope appears on this page. One of our editors sent the letters to the astrologer under the name of Fred'k W. Victor.

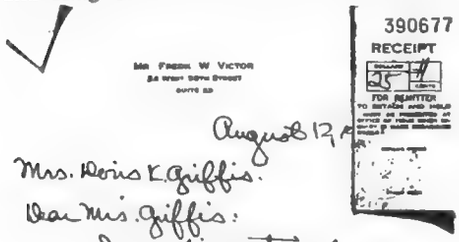
WE promised you gentle readers that we would tell you more about the horoscope humbug. In this month's analysis we take the horoscope as developed by Kelvah Deo Griffis, otherwise known as Mrs. Doris K. Griffis, on the life of one Frederick W. Victor, otherwise known as Frederich Wilhelm Victor Albert —Kaiser Wilhelm, former German Emperor and King of Prussia and son of Emperor Frederick the Third and Victoria, Princess Royal of Great Britain, born in Berlin, January 27, 1859, at 3 P. M. Note particularly that the information which we gave to the astrologer was the exact birth date, the exact time, the exact date of marriage of the then Prince Wilhelm to Princess August Victoria of Schleswig - Holstein-Sonderburg-Augustenburg. Note also that we specified that the eldest son, William, Crown Prince of Germany, was born in 1882. Also remember that there is no book on astrology which does not contain the Kaiser's date of birth; consequently the statement that "you are the Kaiser's double" is a perfectly natural one and if the astrologer had cared to check up the date of marriage and the date of birth of the eldest son and had found that all these factors agreed with those of the Kaiser, he (or she) should have stated that the individual asking for a horoscope *was* the Ex-Kaiser. Wouldn't you think so?

Supposing I were to tell you that the Kaiser was born on January 27, 1859, at 3 P. M., in or near Berlin and that another person was born at the same place at exactly the same time. Supposing I were to tell you that the Kaiser was married in 1881 and that his wife was now deceased and that this other person was also married in 1881 and his wife deceased. Supposing I were to state that the Kaiser's eldest son was born in 1882 and that the other person's eldest son was born in 1882. Supposing I were to advise that both individuals had seven children and suppose I were to further make mention that the Kaiser's given names were Frederich Wilhelm Victor Albert and that this other person's name was Frederick W. Victor, what would be your reaction? Would you not say that both individuals are one and the same? If two finger prints are exactly identical in as many different places as the two individuals above referred to are identical in as many different ways, it is assumed that the finger prints are made by the same individual. Why not in

(*Continued on page 667*)



The chart drawn up by Mrs. Griffis showing the influences on the life of Kaiser Wilhelm.



Mr. Fredk. W. Victor
54 West 58th Street
Suite 53

August 12, 1926

Mrs. Doris K. Griffis.

Dear Mrs. Griffis:

In confirmation of my conversation with your secretary yesterday afternoon, I enclose ~~twenty~~ five dollars ($25.00) for a written horoscope.

Date of birth, Jan 27, 1859.

Please forward horoscope to above address at once, as I expect to leave for Europe next week.

Very truly yours
Fredk W. Victor

The first letter and money order receipt to the astrologer making this report.

$6,000.00
For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

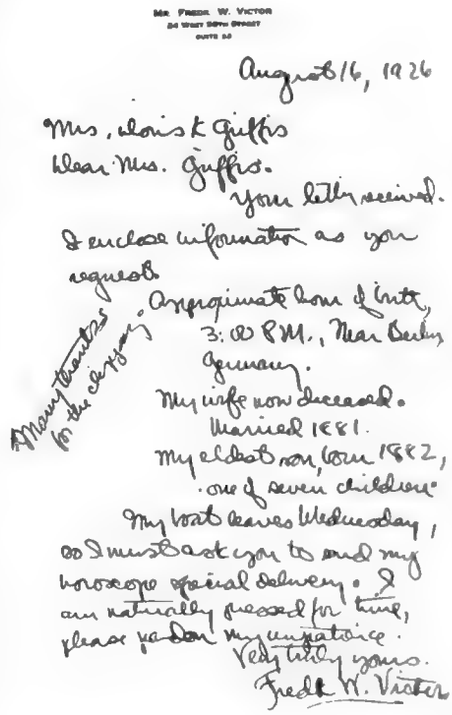
Accordingly, this publication has decided to award an Astrology Prize of $6,000 for the following:

$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates will also be supplied by this office.

This contest closes October 1st, 1927, and all entries must reach us by that time. In event of a tie, prizes of an identical nature will be given those so tying.

Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 53 Park Place, New York, N. Y.



Mr. Fredk. W. Victor
54 West 58th Street
Suite 53

August 16, 1926

Mrs. Doris K Griffis
Dear Mrs. Griffis.
your letter received.
I enclose information as you request.
Many thanks for the same.
Approximate hour of birth, 3:00 P.M., Near Berlin, Germany.
My wife now deceased.
Married 1881.
My eldest son, born 1882, one of seven children.
My boat leaves Wednesday, so I must ask you to send my horoscope special delivery. I am naturally pressed for time, please pardon my impatience.
Very truly yours.
Fredk W. Victor

Note the detailed information supplied to Mrs. Griffis in this letter.

Our Spiritualistic Investigations

By Dunninger.

NO. 4 OF A SERIES

". . . The trick that she employed to read my questions was an exceptionally clever one. As I stood the slate erect and re-read my questions, the little wonder lady did likewise. She walked out of the room directly into another, where she opened the panel in the wall in back of me." It is thus seen that the mystic spiritualist had no difficulty in obtaining the complete text of the questions."

A COLORED MYSTIC

IT was a hot mid-summers day in August. The Georgia sun was beaming brilliantly upon the thin roofed extension of our hotel. A breeze or two seemed to find its way to our windows, and emphasized its presence by the rustling of the leaves, grouped densely about us. It was one of those days when the earth seemed to sprout fire, and even talking seemed a burden. A group of ladies, and several gentlemen, who were stopping at our hotel, seemed so engrossed in the subject of their conversation, that it grew to be an almost public debate. Quite unconscious of their listeners-in, of which I was one, rather by force than choice, on account of the loudness of their voices they kept on.

"I would never have believed it," said one of the ladies, "but this woman *did tell* me the truth." "Nonsense, indeed," said a gentleman, in reply to this lady's proclamation. The gentleman who spoke, had been pointed out to me several days before, as a surgeon of wide reputation, from the Middle West. "These women are great psychologists," he continued. "They are students of human nature. They analyze their victims, as they enter, and treat them accordingly." "You are quite wrong," came the lady's sharp reply. "This Mrs. Baxter is quite illiterate. Her grammar is poor, her schooling apparently neglected, and all these things considered, she could not tell me the things she did, by anything other than a remarkable power of sight into the unknown. She actually told me my name . . . . of my recent trip abroad . . . . and the names of some people I met there."

"Is it not probable, madame . . . . ," said Dr. . . . . , "that you gave this lady the information beforehand, not strictly conscious of all the conversation that transpired between you. So many do, you know, and being believers, quickly forget what has transpired. They then sit amazed and bewildered, when the self-same thing is repeated to them, in another form. With apologies to your cleverness, Madame . . . . . , women actually, sometimes, with an endeavor to conceal a secret, unconsciously expose it, unknowingly, especially when surrounded by an air of mystery, or what is greater still, by an abundance of belief, in things as uncanny as the spiritual seances." "Perhaps so," again came the quick witted reply, "but you fail to realize, doctor, that all women are not so easily led, and truly, doctor, I do not think myself any more capable of unconsciously doing a thing of this sort than you would be." It was quite apparent that the young lady had been peeved, and in accordance with her further proclamation, perhaps righteously so, she continued, "I do not think it fair to me, nor to this colored fortune teller, when you insist upon criticizing the lady's ability, without putting her to the test. I feel assured that, were you to personally investigate the uncanny power she possesses, you would realize that it is quite as easy for her to mystify a man, of your admitted mentality, as it was for her to puzzle me." Laughingly the doctor apologized, and with suave sentences, assured the lady that no offense was intended, but he felt certain that she had been subjected to some clever trick or other, and was fooled, because of the fact that she set out to be deceived. By this time, my interest had been aroused, and without disclosing my identity, I was soon a member of the discussion. I listened with interest to the lady's description of what had transpired, and secured the address of this wonder-woman, without much persuasion.

That evening, shortly after s[unclear] left my hotel and made my way

(*Continued on page 6*

$21,000.00 for Spirits

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent? Should we not consider every psychical manifestation as being trickery pure and simple, intended primarily to fleece those who visit the circle and who find solace in the words from the worst forms of charlatans, namely those who are being permitted to practise upon the poor, seeking words from loved ones?

To the $10,000.00 which has previously been repeatedly offered through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine, we now add another $10,000.00.

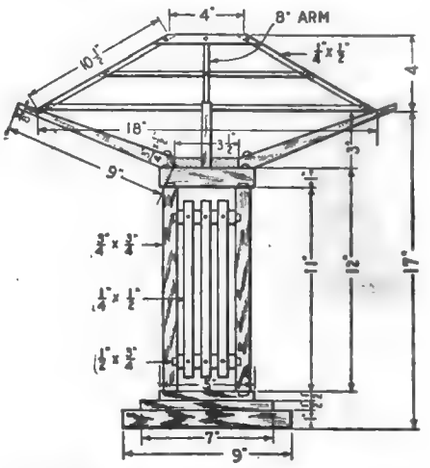
So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

WINNERS IN $300.00

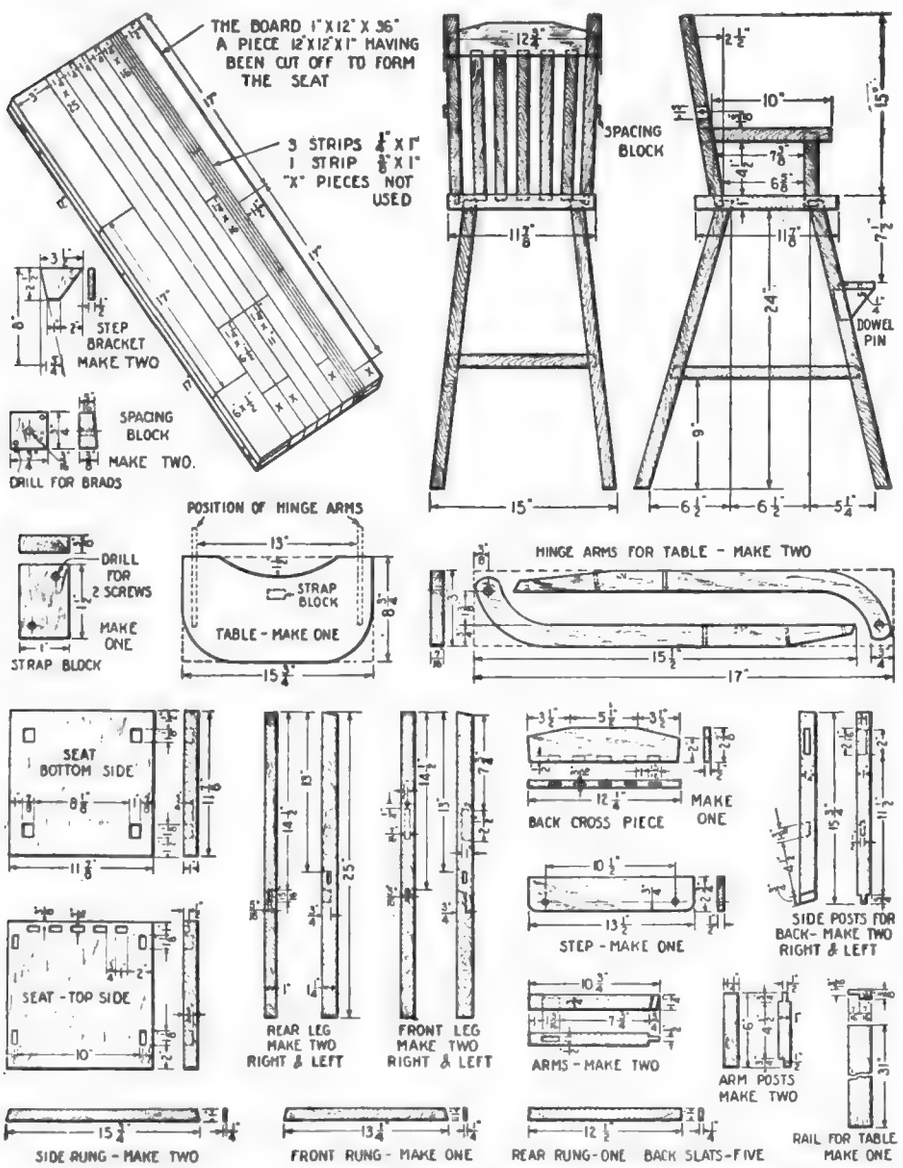
First Prize $75.00—Lamp, Second Prize $50.00—Music Rack

First Prize — $75.00 was awarded in the Wooden Board Contest announced in the June issue of SCIENCE AND INVENTION Magazine to Mr. Arch Hogue of Boulder, Colo., for the construction of a mission type of lamp illustrated in the photographs and diagrams found here. This construction is made from the wooden board 4 feet long, 12 inches wide and 1 inch thick.

It will be remembered that this publication specified that a certain size of a board must be used in the construction of any articles which were to be entered in the contest. The contestants showed some remarkable ingenuity in cutting the board and in making the various items which won the prizes. The photograph above shows the First-prize lamp. Even the shade of this construction is made from the wood originally specified.



The above diagram gives the details of construction of the lamp and indicates all of the dimensions. To complete the construction, one need not purchase any more than one board, the overall size of which is 4 feet, its width 12 inches and its thickness only 1 inch.


THE BOARD 1"X12"X 36" A PIECE 12"X12"X1" HAVING BEEN CUT OFF TO FORM THE SEAT
3 STRIPS ¾"X1"
1 STRIP ⅝"X1"
"X" PIECES NOT USED
STEP BRACKET MAKE TWO
SPACING BLOCK
MAKE TWO.
DRILL FOR BRADS
POSITION OF HINGE ARMS
DRILL FOR 2 SCREWS
MAKE ONE
STRAP BLOCK
STRAP BLOCK
TABLE - MAKE ONE
SPACING BLOCK
DOWEL PIN
HINGE ARMS FOR TABLE - MAKE TWO
SEAT BOTTOM SIDE
SEAT - TOP SIDE
REAR LEG MAKE TWO RIGHT & LEFT
FRONT LEG MAKE TWO RIGHT & LEFT
BACK CROSS PIECE
MAKE ONE
STEP - MAKE ONE
ARMS - MAKE TWO
SIDE POSTS FOR BACK - MAKE TWO RIGHT & LEFT
ARM POSTS MAKE TWO
RAIL FOR TABLE MAKE ONE
SIDE RUNG - MAKE TWO
FRONT RUNG - MAKE ONE
REAR RUNG - ONE
BACK SLATS - FIVE

High Chair Wins Third Prize—$35.00

The photograph below is only one of several which J. H. Vockeroth of Outlook, Sask., Canada, sent with his third-prize winning entry; a high chair.

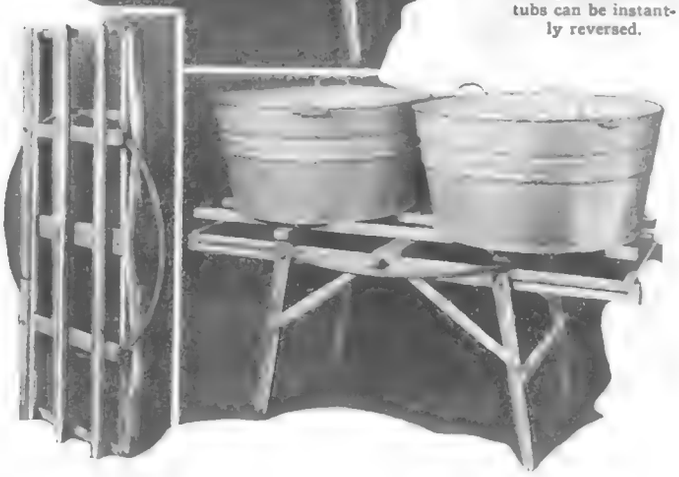
In the diagram at the left, the complete details for duplicating the construction of a high chair with but a small board is indicated. Mr. Vockeroth took particular care to demonstrate exactly how he cut the board. Note that not only is the board cut lengthwise, but portions of it are also sawed crosswise. This enables him to get thin strips for the back chair slats without sacrificing material or the strength of the rest of his construction. So that those readers who did not get the June issue of SCIENCE AND INVENTION Magazine may understand what the board contest is about we would advise that all contestants were supposed to send three 5"x7" photographs of any practical article made from a wooden board 4 feet long, 12 inches wide and 1 inch thick. Accompanying the entry, a pen and ink drawing giving full dimensions of the article was to be furnished and a description of 500 words or less was also necessary.

THERE ARE 21 PRIZE WINNERS IN THE WOODEN BOARD CONTEST.

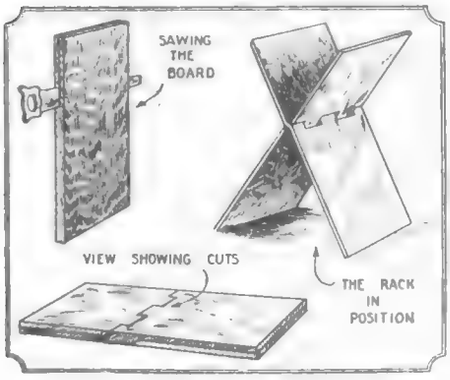
BOARD CONTEST

Third Prize $35.00—High Chair; Fourth Prize $25.00—Wash-Tub Stand.

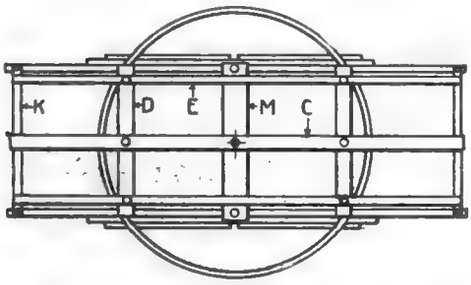
Fourth Prize—$25.00. The wash-tub stand or a folding rotary bench was made by F. D. Van Volkenburg of Kalamazoo, Mich. The details of the construction and the manner in which the board was cut for this stand is illustrated at the bottom of the page.

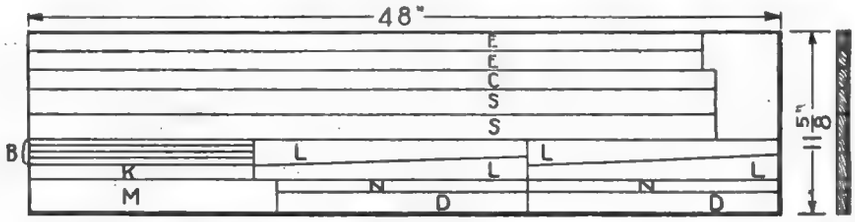


The three photographs at the left give different views of the fourth prize winning entry in the folded and erected positions and also of the same device in use. The position of the tubs can be instantly reversed.

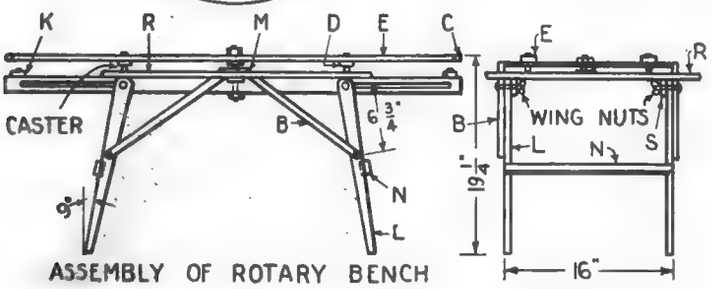


Second Prize—$50.00 was awarded to W. G. Bridge of Chestnut Hill, Mass. Mr. Bridge discovered a piece of board and cut it to the dimensions named in the original contest. This board had a characteristically beautiful grain enhanced by a knot. He sawed the board lengthwise as illustrated at the left and then cut it so as to form a series of box joints similar to those found in pliers. A key hole saw and a chisel facilitate this work. The finished music rack is shown in the photos above.

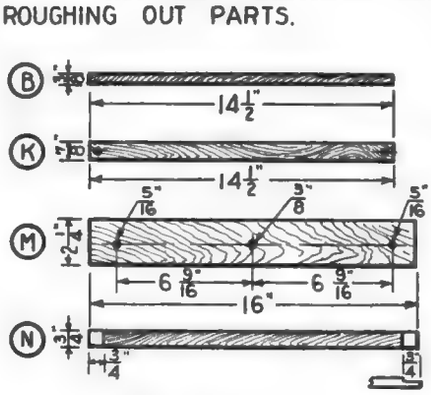


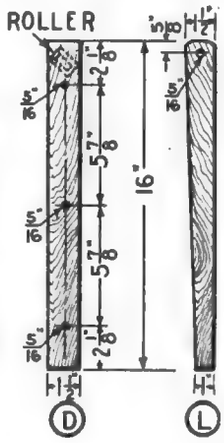


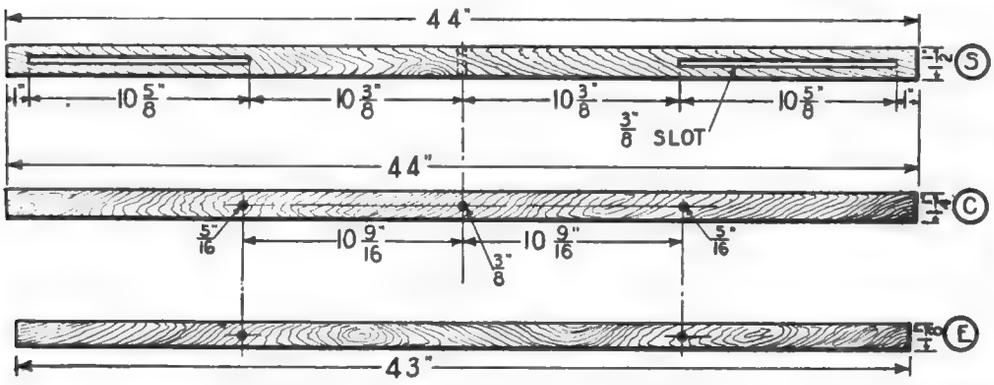
LAYOUT FOR ROUGHING OUT PARTS.

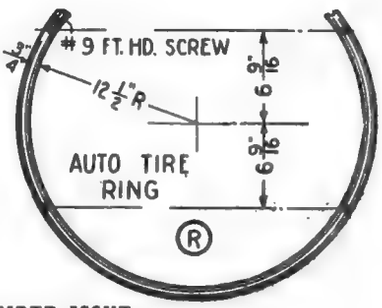


ASSEMBLY OF ROTARY BENCH









WATCH FOR THE FURTHER PRIZE WINNING ENTRIES IN THE DECEMBER ISSUE.

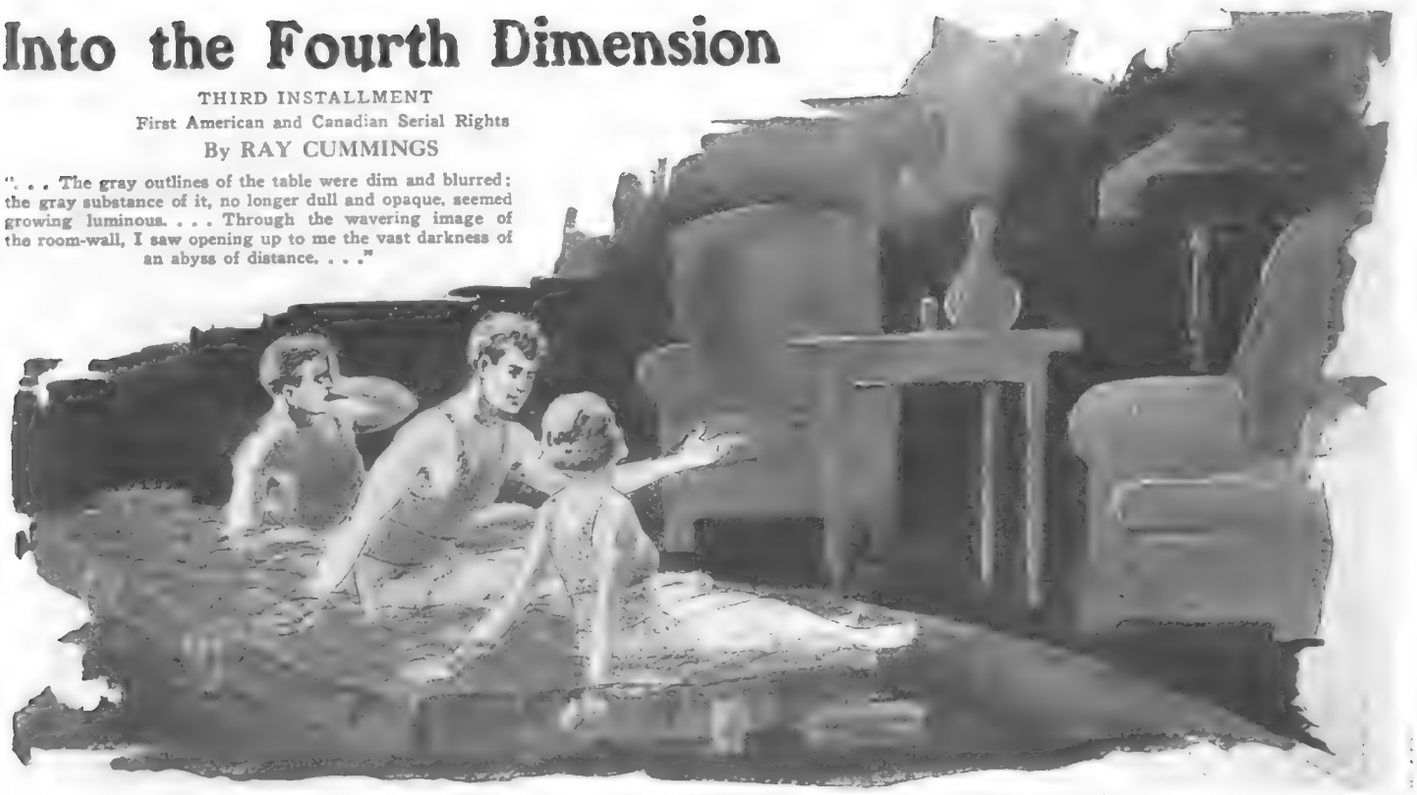
Into the Fourth Dimension

THIRD INSTALLMENT

First American and Canadian Serial Rights

By RAY CUMMINGS

". . . The gray outlines of the table were dim and blurred; the gray substance of it, no longer dull and opaque, seemed growing luminous. . . . Through the wavering image of the room-wall, I saw opening up to me the vast darkness of an abyss of distance. . . ."



CHAPTER V

LAST PREPARATIONS

COMMITTED thus by my own quiet words, involuntarily spoken as though by a volition apart from me, I strove for calmness. A confusion of mind possessed me. But Bee was quite calm; and presently, though within me the surge of apprehension continued, outwardly I believed I did not show it.

Three of us going into the shadows. And Will said, not to linger this time in the Borderland, but to go on—to penetrate into the depths of the Unknown realm beyond. The very thought of it brought a score of anxious questions to my mind; but when I tried to voice them Will crisply checked me.

I realized now, with an emotion tinged by a faint whimsicality, that Will and Bee had summoned me here this evening with an anticipation of just this outcome. They had forseen that we all three would make the trip together. They were prepared for it; and Will's first trial had been experimental wholly.

Thus, I found them ready. Two others of the knitted suits were at hand. Two other batteries. But we—Bee and I—had been seemingly indispensable in aiding Will. His departure—Bee had been by his side to remove the battery wires. And far more important, when he returned, his solidifying shadow had lain beneath the mattress. We had been there to raise him up, to hold him until the substance of his body was great enough for the mattress to sustain it. Suppose we had not raised him? Suppose while yet within the mattress space—or within the space the floor of the room itself was occupying—the growing solidity of him had demanded empty space of its own? The thought brought a shudder—a thought too horrible to be dwelt upon.

During our brief preparations—which Will hurried with a grim haste—he did not once volunteer to explain his experience. And only once did Bee question him.

"You'll tell us exactly what we are to do?"

"Yes. Presently—before we start."

"You said there was need of haste? A real danger to our world here—from those—other beings?"

He was arranging the batteries. "Yes, Bee. A real danger."

"You think we can repulse them? Just three of us going in there? Strangers—"

Strangers indeed. No adventurers into other lands in all the dim pages of history could have felt, or been, such strangers.

He interrupted her. "We will do our best. It is necessary—our efforts . . . We will have plenty of time for consultation, Bee. You will understand, when we are there . . . Pour three glasses of water, Rob."

Synopsis

Robert Manse, a correspondent in the New York Office of a Latin-American export house, in company with Wilton Grant and his sister Beatrice, saw the first of the ghosts in February, 1946, a few miles from Rutland, Vermont. These ghosts were semi-transparent, glowing figures much resembling human beings. Attempts to destroy them with bullets or clubs had no effect on the shadows. Passing the hand through the space occupied by one of these ghosts produced no tangible sensation. Later, the ghosts became more bold and more numerous, even molesting human beings and causing at least one death in Kansas, the result of heart failure induced by the fright of encounter.

Some time later, Will calls Rob on the telephone, saying that his sister Bee is quite ill and asking Will to pay them a visit. During the visit Will mentions that the ghosts have already arrived in the Borderland lying between their world and ours, and that they were on the point of coming into our world. Rob himself has discovered a means of entering into this borderland, and declares that even though he is being watched by many of the ghosts he will make an attempt to-night to enter their realm and turn the spirit-like creatures back into their former paths. While he makes the journey, Rob is to stay behind with Will's sister, Beatrice.

The preparations for the experiment are made, and Will clasps upon his arm a connection to the vibration-transformer which, by altering the vibrations of his body, is to transform it from normal substance to the wraith-like material of the other world. They see a ghostly form watching them as Will's body becomes transparent, but finally the apparatus is disconnected and they wait for his return. Five hours later, Will returns saying that they must go back with him to save the world from an invasion of the ghostly hordes.

Now continue with the story.

My fingers were trembling; it seemed strange that Bee could maintain such calmness. But it was simulated for she said:

"Will, is it—is it very horrible—the changing, I mean?"

He stopped before her, put his hands on her shoulders. His face, so set with its purpose he had forgotten the human feelings of her, softened momentarily with affection.

"Brave little Bee. No—it is strange—frightening at first. But not horrible. And you forget it soon. Then it's merely strange, awesome—you'll see—"

He broke off, turned away, and as momentarily his gaze touched me, he smiled. "Awesome, Rob. But for me, this second time, it will be no great ordeal. Even exhilarating—strangely so. You'll see . . . We're about ready, Bee."

She took her woven suit and retired. I was soon undressed and into mine. Its fabric was queerly light of weight, and for all its metallic quality it stretched readily, almost like rubber as I put it on. Somehow donning that garment made me shudder. It seemed unnaturally chill as it touched my skin.

Bee presently returned, garbed as we were. In spite of my perturbation, my fear of the dread experience which lay before me, I felt a thrill of admiration as I beheld her. So slim of figure, straight of limb, graceful; and with her grave, intelligent face full of one set purpose—to aid us in every way she could.

"We're ready," said Will briefly. "Here are your belts."

We fastened the broad belts about our waists. The pouches each contained some small object.

"Don't bother them now," Will objected, as I would have examined them. "Later, when we get—in there, will be time enough . . . We're ready. What we are to do now is simple—I think there will be no mishap. We will seat ourselves on the mattress. You two may lie down; I shall sit up this time."

"Why?" I demanded.

He smiled. "It is only the first time one feels the sensations that they are disturbing. I'm confident of that. We will have the batteries beside us—" Bee was already placing them on the mattress. "At my

signal, we will each disconnect our own. Should either of you be unable—be overcome—I will do it for you."

"But the coming back," I suggested. "We raised you up—"

His smile held a faint ironic amusement. "Don't you think, Rob, we can leave that to its proper time?" He saw my look and added, with the ready apology which made him so lovable.

"Naturally you are apprehensive. But I've planned for that, of course. There are many places where the level of this Borderland—as I call it—coincides exactly with the surface of our own realm. The back corner of the garden outside, for instance. I have remarked it—I can find it—when the time comes for us to return."

Bee said, "Will, I've been wondering—you were gone five or six hours. Were you in there very long?"

His smile was enigmatic. "You can have no conception of this experience—I cannot answer that, Bee—that's why I haven't told you anything—you are so soon to feel and see it for yourself." He was impatient for the start. "I think we're ready. There is so little to do—no chance to forget anything."

With sudden irrelevant thought my heart leaped. That hostile watching spectre . . . My anxious glance traveled the room. Bee said, "It's not here—I've been expecting—I'm so thankful it's not here."

It was not to be seen. I was relieved for that, at least. With a last deliberation we all three seated ourselves on the mattress. Will was between Bee and me. We connected the batteries; I held mine at my side, my nerveshaken fingers trembling, though inwardly I cursed them, fumbled at the switch to make sure I could control it. The pellets were in the palm of my other hand; the glass of water was within reach.

Will said earnestly, "One last thing—and this is important—more important than you realize. Whatever comes, we must keep together. Remember that. You two—strive always to keep with me—close beside me. Whatever impulse you feel—fight it—do not yield to it. Remember you must stay by me."

The words themselves were simple to grasp. Yet beneath them lay a vague import, a suggestion of what was to come, which seemed unutterably sinister. I heard Bee murmuring.

"Yes, I understand."

I said, and marveled at the steadiness of my voice, "Very well, Will—I'll remember."

He said, "Now." I saw his hand go to his mouth. Now I must take the pellets. Within me a torrent of revulsion surged. I must take the pellets—at once. Bee was raising her glass of water. My hand went up; I felt the pellets in my mouth. Acrid. A faint acrid taste spread on my tongue. And then with a gulp of the water I had swallowed them. Breathless I waited, with heart thumping like a hammer, my head reeling, not from the pellets but from this excitement, fright, which swept me uncontrolled.

Will's voice said, "Rob. Your battery—switch it on."

My fingers found the little switch; pushed it. I felt a faint tingling of my limbs; a sudden nausea possessed me; my senses whirled; the room, which all at once had grown very sharp of outline, turned nearly black.

CHAPTER VI

THE MIND SET FREE

I DID not faint, and in a moment I felt better. My vision cleared; the room regained almost its normal aspect. But the nausea persisted. I felt a desire to lie down. Will was sitting erect, but beyond him I saw Bee lying on her side, facing us. I reclined on one elbow, holding up my head that I might look around me.

The faintness was gone. The sweat of weakness was upon me, my forehead cold and clammy; but I could feel my heart beating strongly. When was the change to start? It seemed ages since I had taken those pellets.

Then I heard the hum. It sounded as though apart from me; but I knew it was not for I could feel it. A vibration. Not of my knitted suit; a vibration within me; within the very marrow of my bones.

My gaze was fixed upon the table across the room. Its outlines were very sharp and clear, unnaturally so, with that sharpness of detail which sometimes comes to the vision of one who is ill. Now they began to blur—an unsteadiness as though I were looking through waves of heat. Had the change started? I raised my hand, examined it. No change, save that the receeding blood had made it a little pale.

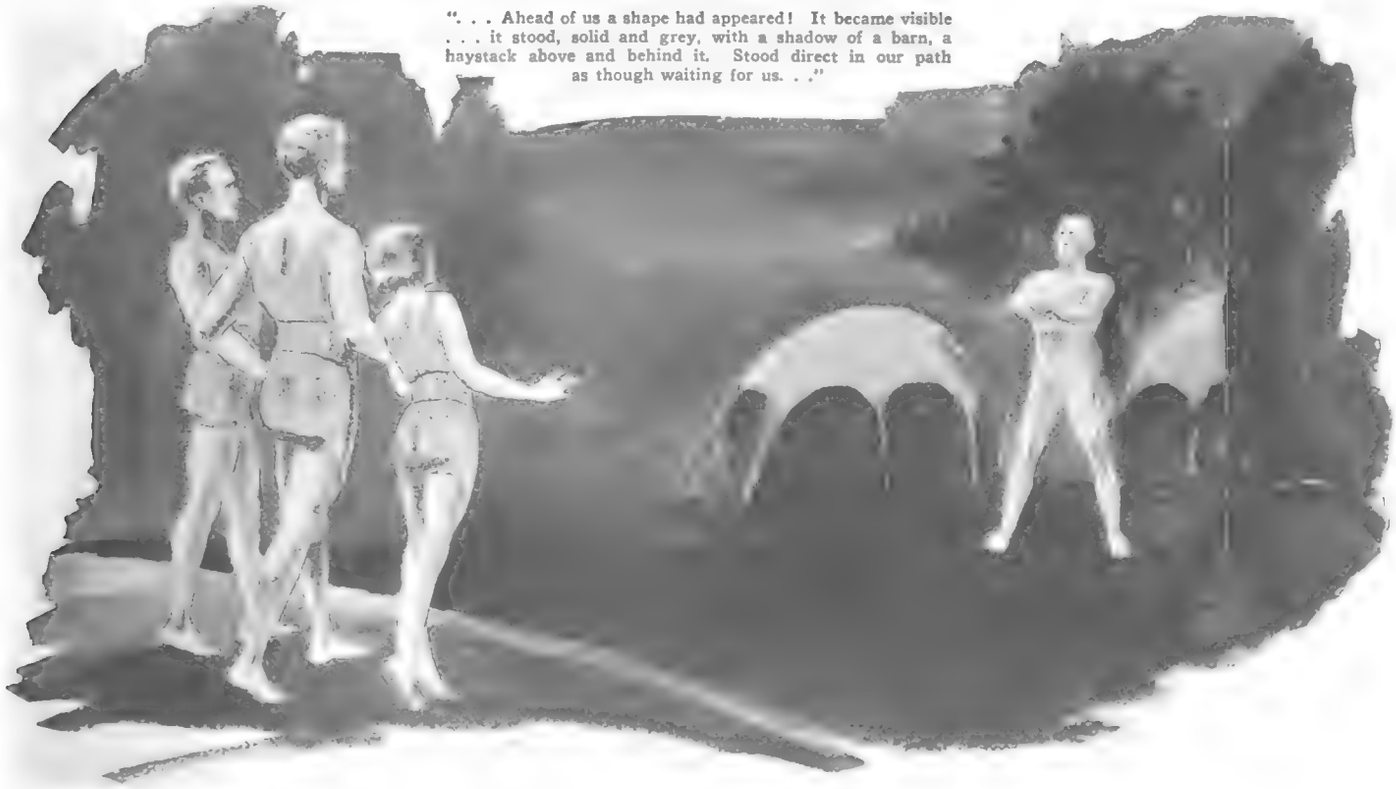
The nausea was now leaving me. A sense of relief, of triumph that I was not ill, possessed me. With every alert faculty I determined to remark my sensations.

The vibration within me grew stronger, though to my ears it was unaltered. And then, abruptly, the change began. My whole being was quivering. Not my muscles, my flesh, my nerves, but the very matter which composed them suddenly made sensible to my consciousness. The essence of me, trembling, quivering, vibrating—a tiny force, rapid beyond conception. It swept me with a tingling; grew stronger, possessed me until for a moment nothing of my consciousness remained but the knowledge of it.

Frightening, horrible. But the horror passed. Again my brain and vision cleared. My whole being was humming; and then I realized that I could no longer hear the hum, merely felt it. The knowledge of sound not the sound itself. And an exhilaration was coming to me. A sense of lightness. My body growing lighter, less ponderable. But it was far more than that. An exhilaration of spirit, as though from me shackles of which I was newly conscious, were melting away. A lightness of being. A freedom . . . A new sense of freedom, frightening with the vague wild triumph it brought . . . Frightening too, for in the background of my mind was the realization that all my physical perceptions were dulling. My elbow was resting sharp against the rough mattress. I dragged my arm a trifle; and dull, far away as though detached from me, I could faintly feel it. I moved my leg. It was not numb. The reverse, it was thrilling in its every fibre. It moved, but I could only feel it move as in a dream. I even wondered if I felt it move at all. Was it not, perhaps, only my *knowledge* that it moved?

Abruptly I became aware that the table across the room had changed. My mental faculties, with all this morbid change of the physical taking place about them, were still

(*Continued on page* 634)



". . . Ahead of us a shape had appeared! It became visible . . . it stood, solid and grey, with a shadow of a barn, a haystack above and behind it. Stood direct in our path as though waiting for us. . ."

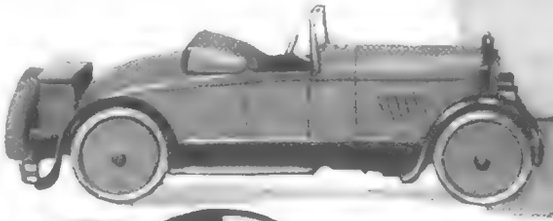
MODEL DEPARTMENT

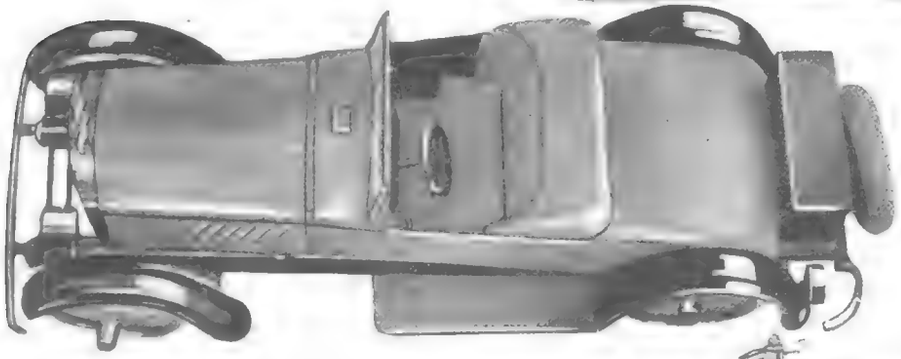
Auto—Wins Seventh Cup

Electrically Driven Model

Made by Lorace L. Wyatt of Florence, S. C.

AVERY interesting and unique model of an automobile which will actually run, won the seventh of the series of cups which SCIENCE AND INVENTION MAGAZINE is offering for the best model submitted during any current month. This model was built by Lorace L. Wyatt of 503 West Evans St., Florence, S. C. Mr. Wyatt confesses in his letter that no machine work entered in the construction of the model, but that it was made entirely from flat tin and copper with such hand tools as are available at any hardware store. The rear deck of the model is made of copper; the tires are miniature pneumatic airplane tires. The differential has a worm drive and is so geared that a small toy electric motor, such as is usually found in toy construction sets has no difficulty in propelling the machine. A small three-cell flashlight battery is carried in the trunk in the rear and there is also room under the rear deck for an extra battery. The individual parts were hammered to fit and then soldered. The car has crown fenders, steering spindles, hub caps, opening doors, a removable ornamental radiator cap and extra tire, wheel and tire cover, license plate, stop light, a set of front lights of the drum type with no-glare lenses, and a German silver radiator shell, a German silver sport bumper in front and rear, full elliptic springs in front and Marmon type of rear springs.



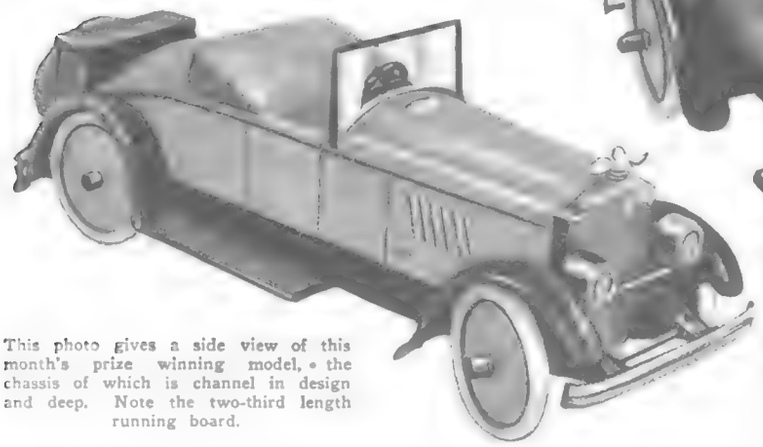


The above photo shows a top view of the automobile which won this month's prize, and illustrates the charming lines of the car. The body has a two-tone paint job. Note the full sport fenders at the front and the bumperettes at the rear, between which the spare wheel and tire is located.

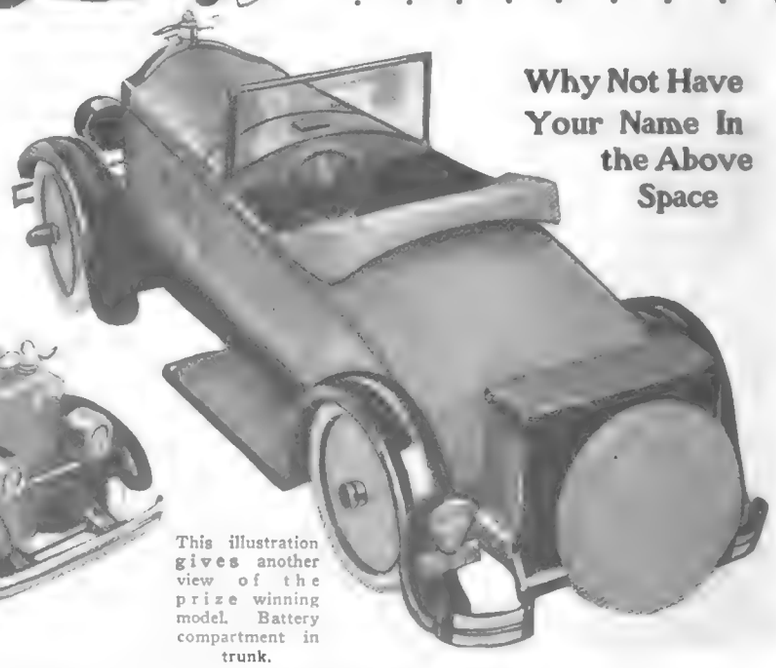
? Who Will Be The Next Cup Winner ?

? ? ? ? ? ? ? ? ?

Why Not Have Your Name In the Above Space



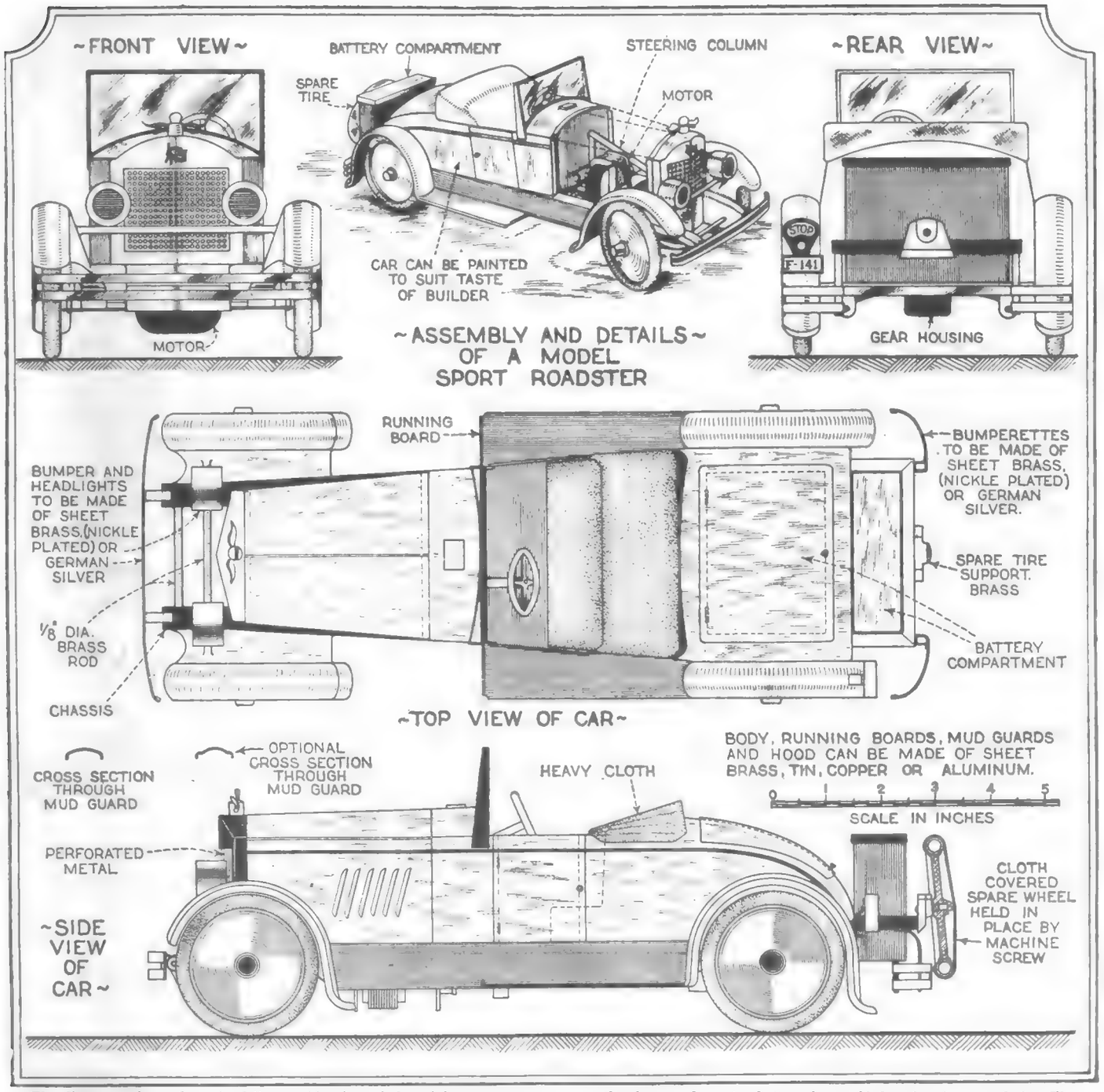
This photo gives a side view of this month's prize winning model, the chassis of which is channel in design and deep. Note the two-third length running board.



This illustration gives another view of the prize winning model. Battery compartment in trunk.

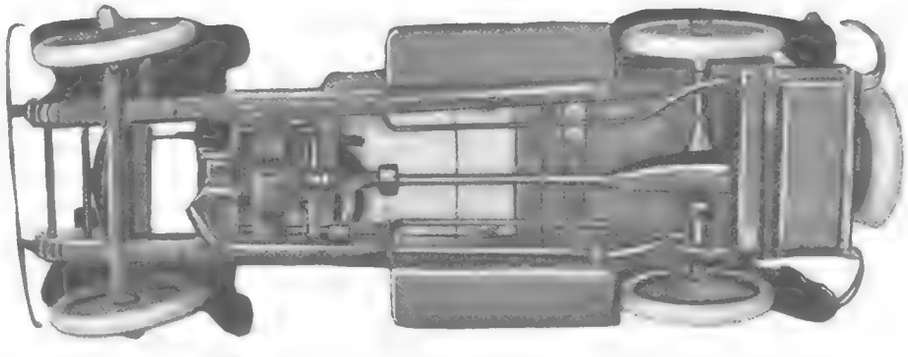
PERHAPS YOUR MODEL WILL WIN THE NEXT CUP. HAS IT BEEN ENTERED?

This Month's Cup Winner


~FRONT VIEW~
BATTERY COMPARTMENT
STEERING COLUMN
~REAR VIEW~
SPARE TIRE
MOTOR
CAR CAN BE PAINTED TO SUIT TASTE OF BUILDER
MOTOR
STOP
F-141
GEAR HOUSING
~ASSEMBLY AND DETAILS~ OF A MODEL SPORT ROADSTER
RUNNING BOARD
BUMPERETTES TO BE MADE OF SHEET BRASS, (NICKLE PLATED) OR GERMAN SILVER.
BUMPER AND HEADLIGHTS TO BE MADE OF SHEET BRASS, (NICKLE PLATED) OR GERMAN SILVER
SPARE TIRE SUPPORT. BRASS
1/8" DIA. BRASS ROD
BATTERY COMPARTMENT
CHASSIS
~TOP VIEW OF CAR~
CROSS SECTION THROUGH MUD GUARD
OPTIONAL CROSS SECTION THROUGH MUD GUARD
HEAVY CLOTH
BODY, RUNNING BOARDS, MUD GUARDS AND HOOD CAN BE MADE OF SHEET BRASS, TIN, COPPER OR ALUMINUM.
0 1 2 3 4 5
SCALE IN INCHES
PERFORATED METAL
CLOTH COVERED SPARE WHEEL HELD IN PLACE BY MACHINE SCREW
~SIDE VIEW OF CAR~

The diagrams above show the full assembly view of the miniature automobile as made by Mr. Wyatt who won the trophy cup in this month's contest. This automobile is operated through a worm gear by a small toy motor and the batteries are found in the trunk at the back of the car and an optional space for extra battery is provided under the rear deck. The dashboard of the auto was hammered in such a shape that it appears to contain the usual dashboard instruments. Crown mudguards were used in the actual construction.

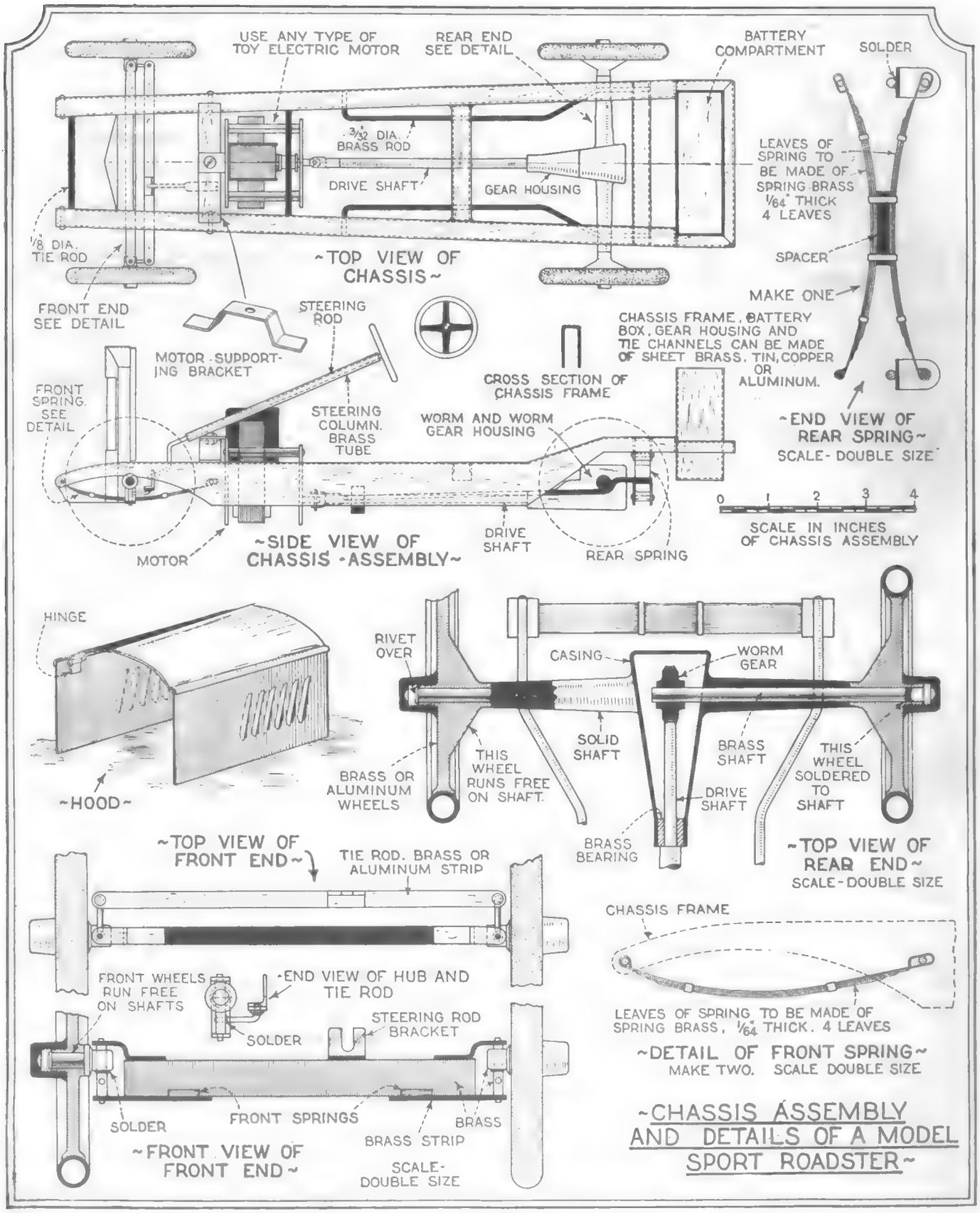
WINNING SCIENCE AND INVENTION Magazine trophy cups seems to be an easy matter to some of our readers. Up to the present time seven cups have been awarded. This is the first one won by a model of an automobile, although there have been several engine models and a few ship models which were previously the fortunate entries. Full details of the conditions for entering this prize contest will be found on page 654. Our readers may enter any type of a model in this contest and win the 17½-inch cup weighing nearly five pounds. A cup is awarded every month for the best model entered which may be of any conceivable type of an engine, an airplane, a submarine, a battleship, a motorcycle, or in fact any article which can be made without the aid of purchased knock-down parts.



The photo above shows a view of the prize winning automobile looking up from the bottom.

BLUEPRINTS OF THIS MONTH'S CUP WINNER CAN BE OBTAINED FROM THE BLUEPRINT DEPT. FOR $1.00 FOR COMPLETE SET.

Model Auto -- Cup Winner



The above drawings show the chassis assembly and the details of the model sport roadster which won the cup in this month's SCIENCE AND INVENTION Magazine Contest. To the readers who do not know about this cup contest, we would advise that with each issue of SCIENCE AND INVENTION Magazine a trophy cup, handsomely engraved is given for the best model of any mechanism which the builder may care to develop. Model ships, airplanes, steam engines, automobiles, motorcycles, gasoline engines and in fact, any form of model may be entered in this contest and may win one of the big cups. SCIENCE AND INVENTION Magazine also has a blueprint service department and our readers may avail themselves of the opportunity of securing the blueprints of prize-winning models at very nominal fees. In the model illustrated above, a small electric motor drives the automobile which even though simply constructed, is remarkably accurate for its size and the interesting feature is that the device actually works.

$5,000.00 MATCHCRAFT CONTEST AWARDS

The photograph here shows Miss Miriam V. Chaims holding the first prize winning model in this month's Matchcraft Contest. An idea of its size can be obtained from the photo.

First prize—$100.00 is awarded in this month's contest to E. S. Nostrand of Brooklyn, N. Y., for his construction of a SCIENCE AND INVENTION Symbolic Temple. Although Mr. Nostrand started to build this model when the contest was first begun, it was not until this month that he completed the game. The pillars are made of matches and on the top a scroll also made of the same material will be found. The dome was built around a large ball and the windows in the temple are painted celluloid, through which a light may penetrate. The construction is 9½ inches wide, 12 inches long and 11¾ inches high. Thousands of matches were required.

As has been repeatedly specified, the decorative effect surrounding the temple is not taken into consideration in the construction of any matchcraft models. The trees in this particular construction are made of sponges.

Grass is formed by a towel.

The two lamp posts in the front of the temple are built up of matches and then carved. Small silvered beads form the lights.

A side view of the temple.

16 Monthly Prizes

First Prize	$100.00
Second Prize	75.00
Third Prize	50.00
Fourth Prize	35.00
Fifth Prize	25.00
Sixth Prize	20.00
Seventh Prize	15.00
Eighth Prize	12.50
9th to 16th Prizes of $10.00 each	$80.00

$5,000.00 Prize "Matchcraft" Contest

WATCH FOR PRIZES IN DECEMBER ISSUE.

FOR the present year, SCIENCE AND INVENTION magazine will award a total of $5,000 in prizes, in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please observe the following simple rules:

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest, lasting for twelve months, each monthly contest closing on the first of the month following date of issue. Thus the contest for the month of November will close December 1, 1926, and prize winning announcements will be made in the February, 1927, issue. The December issue will contain September prize winning entries.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

IMPORTANT

QUITE a few matchcraft models from contestants arrive broken every month, due to faulty packing, or weak construction. It should be remembered that boxes are often violently thrown around in transit before they reach us. Make sure first that your model is constructed strongly enough to withstand severe shocks. Then, before you send us the model, after you have it packed as well as you know how, throw it up almost to the ceiling and let it come down on the floor. Open up the box and see if the model is not damaged. Only after such a test can you know that the model will arrive safely.

All First Prize Awards will henceforth become the property of the Experimenter Publishing Company and will be used for exhibition purposes.

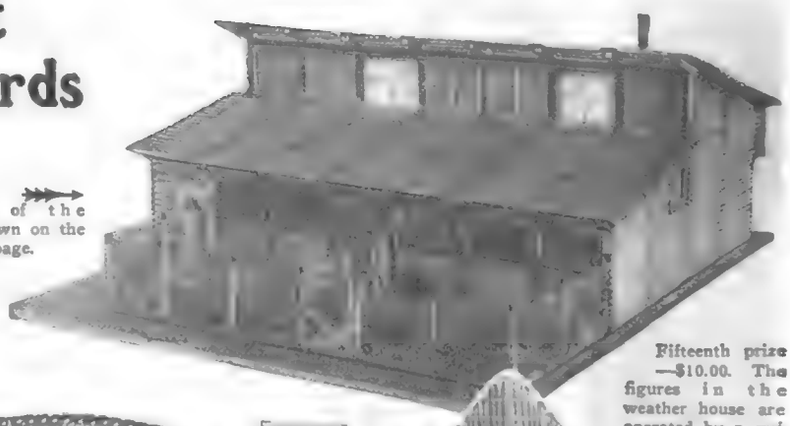
Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

This contest started Dec. 1, 1925, and will terminate Dec. 1, 1926.

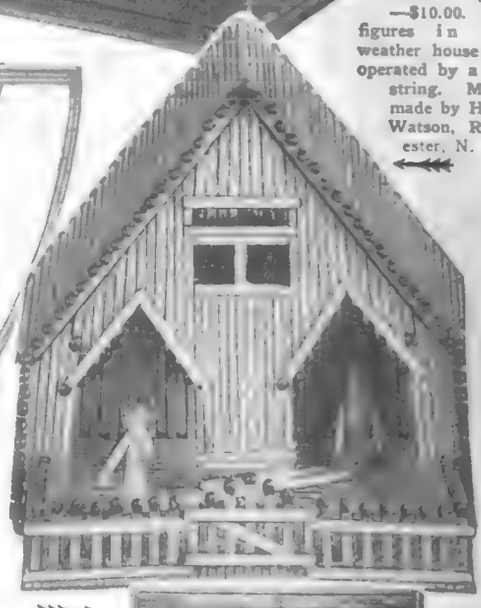
Match-Craft Awards

Thirteenth prize — $10.00 was awarded to Joe Greshaw of Harrisburg, Ill., for his bust of Abraham Lincoln made from a solid block of matches and then carved. The matches were laid in different directions so as to give the face its seeming texture.

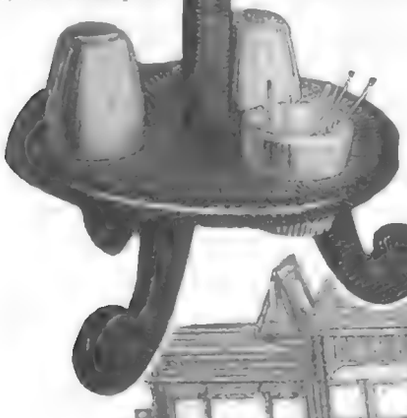
Another view of the fourth prize shown on the previous page.



Fifteenth prize —$10.00. The figures in the weather house are operated by a gut string. Model made by H. S. Watson, Rochester, N. Y.

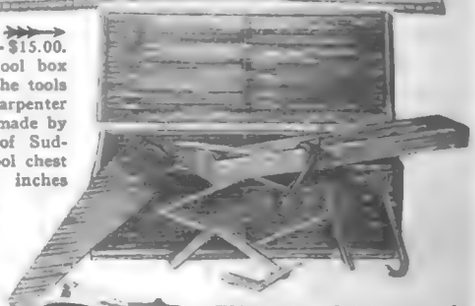


Tenth prize—$10.00. A salt and pepper shaker stand in which the shakers and tooth-pick holder are made of matches, won for its nameless builder, the tenth prize.

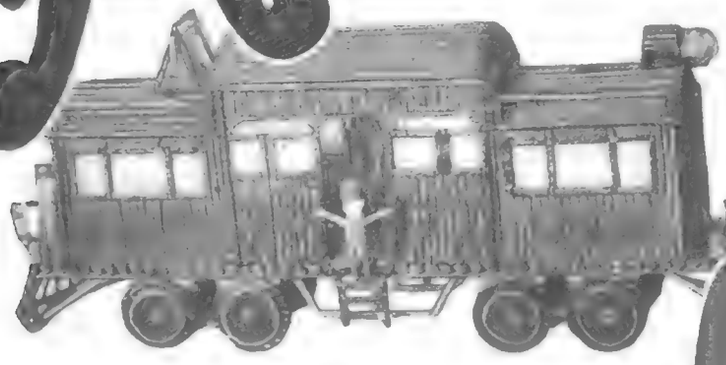


Ninth prize — $10.00 was awarded to the constructor of a matchcraft cup made to simulate the SCIENCE AND INVENTION model trophy cup. Note how the matches at the top are bent. This model was made by W. Kouchi of Wailuka, Mouai, T. H.

Seventh Prize — $15.00. This interesting tool box containing all of the tools required by a carpenter in miniature was made by Grant R. Bown of Sudbury, Pa. The tool chest itself is only 5 inches long and the hinges on the chest are uniquely constructed of match-sticks

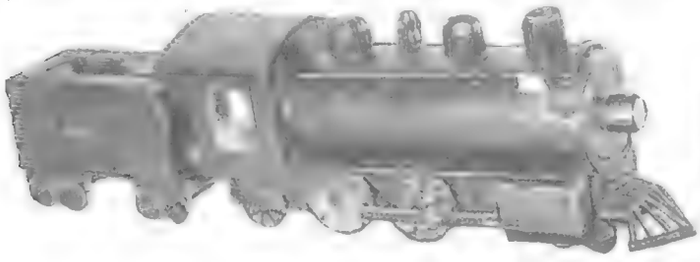


Sixteenth prize — $10.00 was awarded to R. Hasselman of San Jose, Calif., for his model railway car.



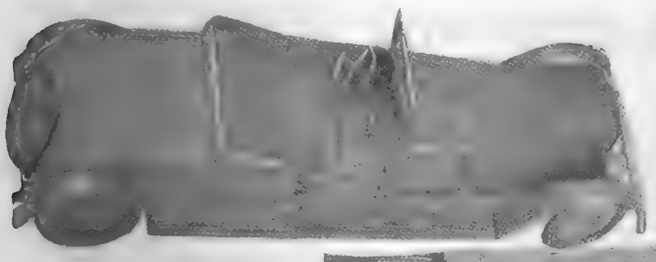
Third prize—$50.00, was given to the builder of a full-sized tennis racket, the strings of which are of matches and in fact the entire construction is made of the same wood. The matches were cut and joined to form the strings. Approximately 5000 sticks entered the construction. Inasmuch as the handle of the racket is solid one can easily see how so many matches were used up.

Eleventh prize—$10.00 was won by C. J. Ewald of Cincinnati, O., for the model of a locomotive and tender illustrated in the photograph below. This model is strongly built as can be noted by looking at the thickness of the sides of the tender.



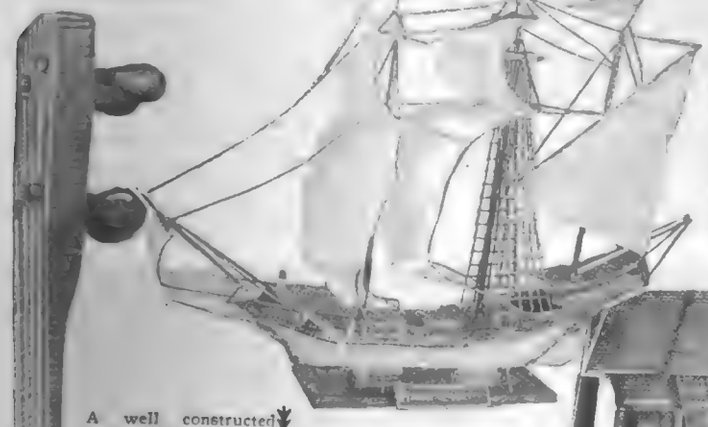
This photograph shows Miss Shirley Hecht holding the third prize winning entry, the tennis racket made by Gordon B. Wood of Pasadena, Calif.

Match-Craft Awards

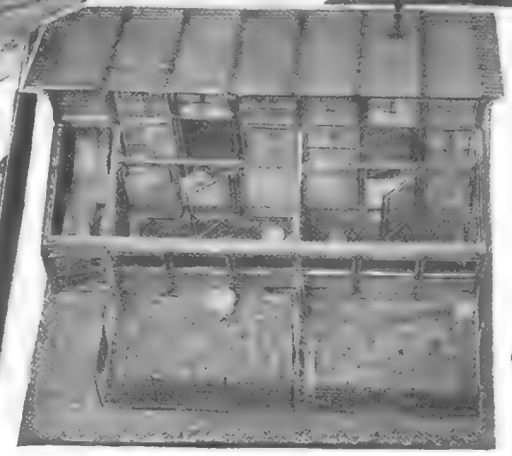


Second Prize—$75.00 The photographs here show a uniquely constructed automobile, 16 inches long fitted with springs, a tie rod, bumpers, a steering wheel which actually steers, opening doors, clutch, brakes, latches for the doors and even a spare wheel, tail light, license plates and headlights. Model made by Sherman F. Wotton, Friendship, Me.

Miss Shirley Hecht holding the second prize winning entry.

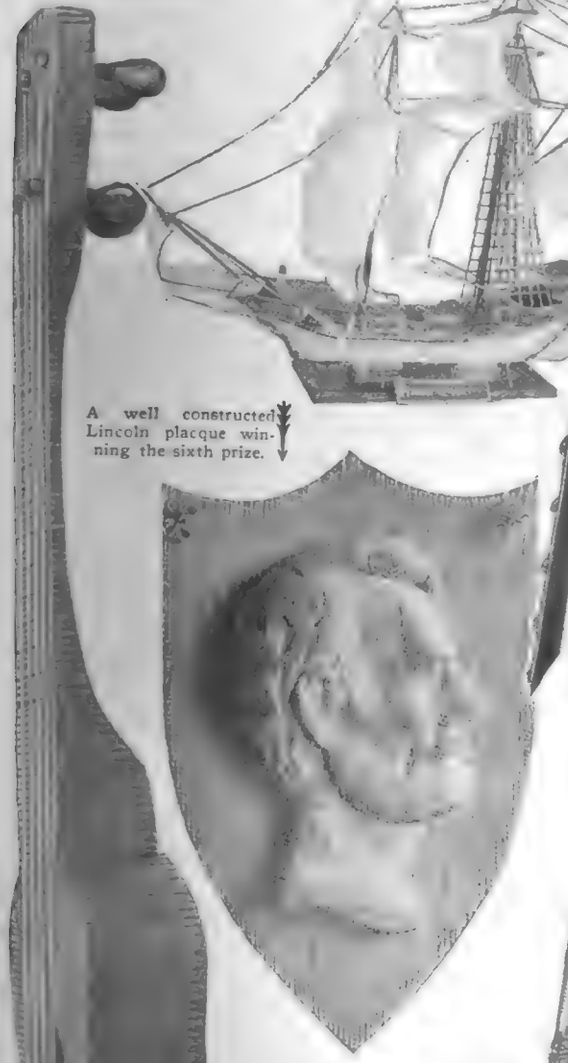


14th prize — $10.00. The matchcraft boat here illustrated has its flags, ropes and ladders made of matches. The model was built by Robert Edgerton of Rocky Mount, N. C., and it seems remarkable that it was not completely smashed in shipping. Front and rear hatches raise.



Fourth prize—$35.00. Quite a few of the models that were submitted in this month's contest are not identified by the builder's name. This is one of them. It represents a chicken farm provided with brooders, incubators, food storage, water buckets and attendant paraphernalia.

A well constructed Lincoln placque winning the sixth prize.

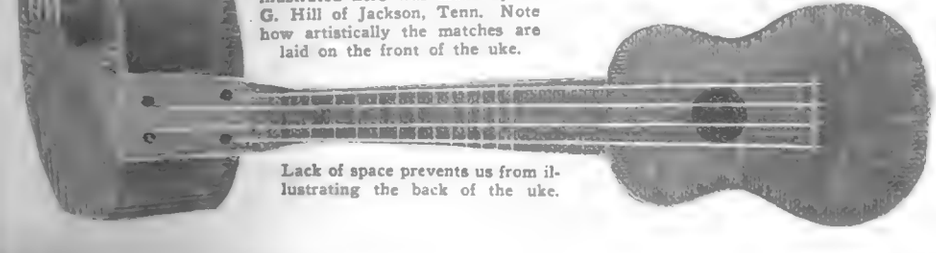


Eighth prize — $12.50. The clock tower here shown is 14 inches high. The builder of the model did not send his name so we cannot tell our readers who constructed this tower.

Sixth prize—$20.00. This plaque on which is carved the head of Abraham Lincoln was made by Joe Janssen of Chicago, Ill. It represents an interesting bit of carving. Thousands of matches were used in the placque which is only 10½ inches olng and 6½ inches wide.

Twelfth prize — $10.00. Risdon Moore of Galesburg, Ill., built the truck here illustrated. It is 6 inches long and rolls very freely.

Fifth prize—$25.00. The ukelele illustrated here was made by F. G. Hill of Jackson, Tenn. Note how artistically the matches are laid on the front of the uke.



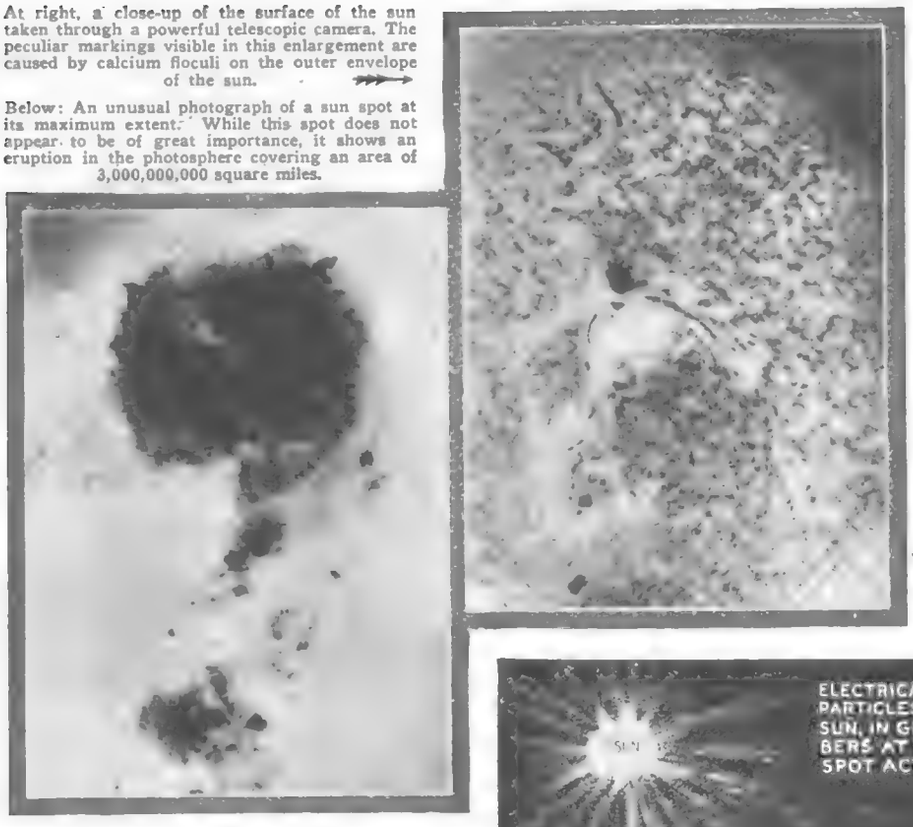
Lack of space prevents us from illustrating the back of the uke.

Sun Spots, the Weather and Crops

By CARRINGTON WOLF, Ph.D.

At right, a close-up of the surface of the sun taken through a powerful telescopic camera. The peculiar markings visible in this enlargement are caused by calcium floculi on the outer envelope of the sun. ➤➤➤

Below: An unusual photograph of a sun spot at its maximum extent. While this spot does not appear to be of great importance, it shows an eruption in the photosphere covering an area of 3,000,000,000 square miles.

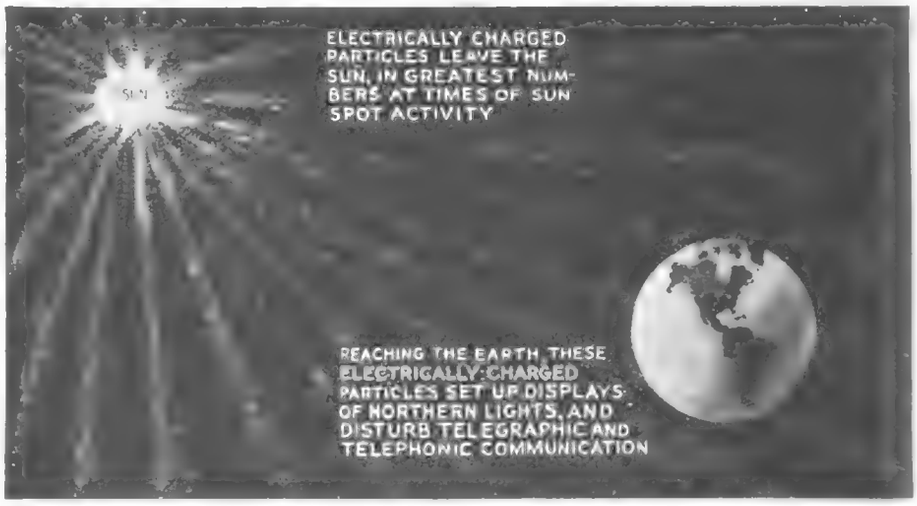


IT has been known for many years that the sun spots slowly increase in number slowly decrease until none are seen for days at a time, and then increase in number again. The cycle averages about eleven years, but may be as short as eight or as long as sixteen years, judging by records going back to 1749. The spots are storms on the sun, and there are variations from the average of eleven years. In the same way, an observer attempting to determine the terrestrial years from observations of snow storms would sometimes find it considerably more or less than twelve months.

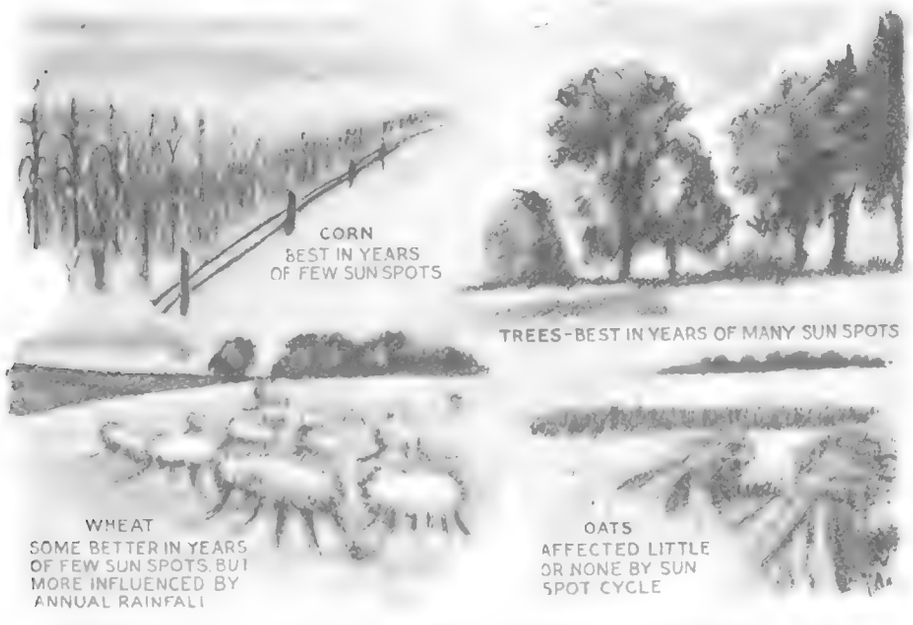
Modern observations have shown that other activities of the sun also vary in this cycle of eleven years. A result of interest recently announced by the Mount Wilson Observatory is that the sun gives off more ultraviolet light when there are many sun spots. Modern research has demonstrated that the curative power of sunlight is in the ultraviolet which does not pass through glass.

The effect on the earth most obviously connected with the sun spot cycle are those associated with the electrically charged particles reaching the earth from the disturbed regions of the sun. In the rarefied upper layers of the atmosphere, a heavy stream sets up a glow, as the particles strike in along the lines of force of the earth's magnetic field. These displays are more pronounced in the polar regions, where the lines of force are nearly vertical, and consequently are referred to as northern lights, or sometimes as auroral displays. Some of the readers will remember the brilliant displays of 1916 and 1918, near the last sun spot maximum.

When a heavy stream of solar electricity reaches the earth a difference of potential will be set up between two regions some distance apart, as for example New York and Chicago. If they are connected by a wire,


ELECTRICALLY CHARGED PARTICLES LEAVE THE SUN, IN GREATEST NUMBERS AT TIMES OF SUN SPOT ACTIVITY
REACHING THE EARTH THESE ELECTRICALLY CHARGED PARTICLES SET UP DISPLAYS OF NORTHERN LIGHTS, AND DISTURB TELEGRAPHIC AND TELEPHONIC COMMUNICATION

Periods of sun spot activity are characterized by electrical distubances of various kinds which cause tangible effects on the earth. Northern lights are one of the most notable and easily recognized of these phenomena. Radio and telegraphic service sometimes suffers.


CORN
BEST IN YEARS OF FEW SUN SPOTS
TREES-BEST IN YEARS OF MANY SUN SPOTS
WHEAT
SOME BETTER IN YEARS OF FEW SUN SPOTS, BUT MORE INFLUENCED BY ANNUAL RAINFALL
OATS
AFFECTED LITTLE OR NONE BY SUN SPOT CYCLE

Research has brought out the fact that vegetable life is influenced to some extent by the periodicity of sun spot disturbances. While these conclusions are open to question, due to the comparatively short period of observation, predications are more or less practical.

current will flow through the wire causing the telegraph and telephone companies considerable trouble. At times communication is practically stopped.

It has been long known that auroral or northern light displays and these disturbances of telegraphic communication, are more common at times of sun spot activity. Two spots were large enough to be seen with only a smoked glass on January 26 of this year, when telegraphic communication was tied up all over the country practically throughout the day. A display of northern lights was visible that evening.

To most people, however, the effect of the sun's activities on the weather and crops is a matter of more interest. Unfortunately, the atmospheric circulation and clouds complicate things considerably, and the weather bureau officials as yet can make no use of sun spot observations in forecasting weather and crop conditions. In spite of this, many interesting results have been obtained, if one is content with rather general statements.

Perhaps the first result of this nature obtained was that temperature records average

highest near sun spot minimum, when the sun is really giving off the least heat. Several investigators have examined records over the world extending back to about 1750, the earliest reliable temperature and sun spot records, and the results may be considered established. To illustrate we have plotted curves showing the temperature change through the sun spot cycle for the New England states, and for Iowa. The weather bureau records for the last 33 years were used in plotting these curves. The New England states being near an ocean, the curve is smoother, and the variation is less than for Iowa, in the middle of a continent.

Modern investigators have found that in tropical countries with a dry climate, the temperature rises when the sun radiates more heat. Clayton states that this happens at Galveston, Texas. This suggests at once the explanation which has been proposed to explain the records over the greater part of the United States and Europe. It is as follows:

As the heat emitted by the sun increases, the greatest increase in temperature will naturally be in tropical countries with a comparatively clear sky. The warm air rises, and other air coming in to replace it increases the circulation over the rest of the world. Over most of the earth, the direct rays of the sun tend to raise the temperature, but the increased circulation of the air, has a cooling effect. The records indicate that at Galveston, Texas, the effect of the sun's rays predominates, resulting in a rise in temperature; but a little farther north, the cool air coming in predominates over the slanting rays of the sun resulting in a lower temperature. As most of the temperature records have been kept in latitudes as far north as New England or Iowa, the average gives a lower temperature.

On this theory one would expect that with an abnormal increase in the sun's heat, the heating effect of its rays would predominate over the cooling effect of the atmospheric circulation for most of the United States and Europe, resulting in a higher, rather than a lower average temperature. Professor Humphreys suggests that this very thing happened in 1778. The "sun spot number" for that year is the highest on record, indicating that the heat of the sun was unusual. The temperature records for that year, instead of being relatively low, are high, and Professor Humphreys suggests that the sun was so hot it raised the temperature not merely in the tropics, but over Europe as well.

Cloudiness is important also, for in a large area of clouded skies the direct rays of the sun are reflected away and can have little effect in raising the temperature even in equatorial regions. The increased circulation results in a cooling. Some investigators believe that on the average it is a little more cloudy near sun spot maximum, and that this explains the average temperature over the world, seeming a little cooler.

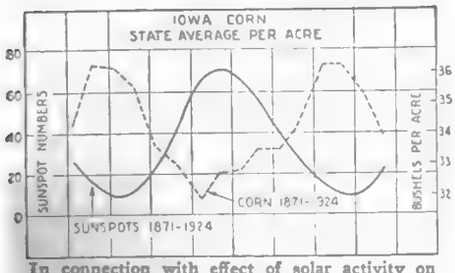
The most complete investigations of rainfall records, for example the work of Alter, have shown little relation with the sun spot cycle in most places. To illustrate this point we are including curves showing the rainfall records for the past thirty-three years averaged on the period of one cycle for New England and for Iowa. One might suspect that in the New England States the most rain is two years after sun spot maximum, but in Iowa no relation is apparent.

Since there is without doubt a temperature change it is reasonable to suspect that crops would show the effect of the sun spot cycle. One might also suspect that the change in the amount of ultra-violet light would affect the growth of vegetation. A few years ago Douglas of the University of Arizona made a very complete investigation of the growth of trees in relation to the sun spot cycle. European trees, trees in Vermont, Arizona and the big trees of California were investigated. It was found that in general the growth rings were thicker in the years of many sun spots. Some sections of trees showed the solar cycle in a remarkably clear fashion. Recently the relation of the corn crop to this cycle has been investigated at the University of Iowa. From records of the average yield per acre in the state for the past fifty-five years it was found that the corn crop averaged about four bushes per acre higher near sun spot minimum. This is probably because corn is a warm weather crop, and the best yield is obtained on the average in the years of higher temperature. The wheat crop shows the same effect to some extent, averaging a little better in the years of few sun spots, but it seems to be more affected by differences in the annual rainfall than corn. The yield of

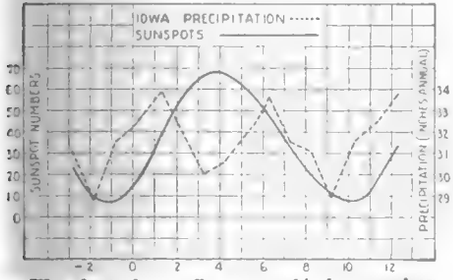
(*Continued on page* 653)

WITH SUN SPOT ACTIVITY THE SUN RADIATES MORE HEAT
WARMER HERE, IN REGIONS OF CLEAR SKY, NEARLY DIRECT RAYS OF SUN. AIR RISES
EARTH

Sun spot activity has been shown to have some noticeable effect upon the sequence of the seasons and the intensity of temperature extremes. A little study of the above drawing will make clear the principle upon which this effect is dependent. The unusual weather experienced throughout the world for the past few years may be due in large part to such disturbances.



In connection with effect of solar activity on vegetable life, it is interesting to compare the Iowa corn crop with the sun spot calendar.



The chart above offers a graphical comparison between sun spot activity and precipitation.

THE SUN RADIATES MORE ULTRA-VIOLET LIGHT AT TIMES OF SUN SPOT ACTIVITY
THE CURATIVE PROPERTIES OF SUNLIGHT ARE IN THE ULTRA-VIOLET, WHICH DOES NOT PASS THROUGH GLASS. IT MAKES HEALTHY CHILDREN, MAKES COWS GIVE BETTER MILK AND HENS LAY BETTER EGGS

Sun spot disturbances cause an increase of ultra violet radiation which increases the curative and beneficial effects of the sun's light on animal and vegetable life in general.

X-Ray Exposes Doctored Painting

Above photograph shows a portrait of a lady painted by Frans Pourbus now on exhibition in the Metropolitan Museum of Art. This photo depicts the lady's face covered over with new pigments. The ideal portrait here shown became the real portrait at the right.

An X-ray photograph showed that the work was of an old master and differed in several respects from that on the surface.

The photo above is the same portrait as at the left after the new paint had been cleared away. The work was done under the supervision of Edward W. Forbes at the Fogg Art Museum of Harvard University with money from the Milton fund.

THE problem concerned a photograph of a lady which was attributed to the painter, Frans Pourbus and to solve the problem, X-rays of the painting were taken. It was discovered that the lady's face was covered over by newer pigments through which the X-rays pass quite readily, whereas the older painting underneath intercepts X-rays to a noticeable degree. The examiners also found that the painting beneath was more real and it did not have the prettiness of the ideal face which the painting portrayed. The X-rays showed that the only damages were a chip out of the forehead and a crack running through the left side of the face. The cross bars over the entire panel are shadow records of the cradling which braces the panel at the back. The Metropolitan Museum of Art had the paintings cleaned of its repaints and fillers and obtained the result shown in the photograph at the right. In this manner an authentic portrait characteristic of the time in which it was painted was obtained.

$38,000.00 IN PRIZES

Offered by Science and Invention Magazine

$21,000.00 is offered by this publication for proofs of spiritualism. The editors of SCIENCE AND INVENTION Magazine do not believe that any authenticated cases of spirit manifestations or phenomena have ever been produced. They hold that all spirit phenomena are fraudulent in nature and that those organizations which try to entice people into their circles to ostensibly listen to messages from beloved ones who have passed from this world into the next are carrying on a fraudulent game which is more harmful than good. This publication does not mean to infer that legitimate forms of religion are harmful. Its fault is only with that form masquerading under the guise of "spiritualism" and purporting to give messages from the spirit world. See page 597.

$6,000.00 will be given by this publication for proofs of "astrology." SCIENCE AND INVENTION Magazine holds that there is no truth in astrology, and that it is not a science and that statements made by astrologers, unless they are very general, cannot be seriously entertained. This publication will, therefore, pay $5,000.00 to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same, and who will describe in advance each event in detail, giving the location and the result or the casualties if the event is an accident. This journal will also pay $1,000.00 to the astrologer who will produce three accurate and perfect horoscopes of individuals whose initials and dates of births will be supplied to him. For further details, see page 596.

$5,000.00 will be paid by this publication during the fiscal year for models built entirely of matches. The entire construction of these models must be of the wood of matches, the heads of which should preferably be cut from the wooden sticks. Although this contest was primarily intended for shut-ins, it is not limited to those unable to get about other businesses. Full details of the contest as well as this month's prize winning contestants and the models which they built are to be found in this issue on page 605.

$5,000.00 will be paid by SCIENCE AND INVENTION Magazine to the individual or individuals who will demonstrate a working model of a perpetual motion machine at the offices of this publication. This magazine does not believe that perpetual motion is possible, and this award is primarily made as a protection for those who would invest in constructions of this nature. Many times a would-be perpetual motion inventor will tell prospective investors that he needs just a few more dollars to patent his invention, that his machine is the only one which will operate, and that it has received recognition in the scientific world. The story told in present-day circles is that the inventor has collected millions of dollars for his system from any one of the large automobile manufacturing concerns. Under the latter circumstances, the inventors claim to do investors a favor by permitting them to invest. Those telling the first story will patent the invention as soon as they get the additional funds. To both of them the editors say that they will pay them $5,000.00 when they merely exhibit a working model of the device. We desire no rights to the invention whatsoever.

$1,000.00 and more is being paid every month by SCIENCE AND INVENTION Magazine to its authors. Articles are all paid for, except those written by our staff.

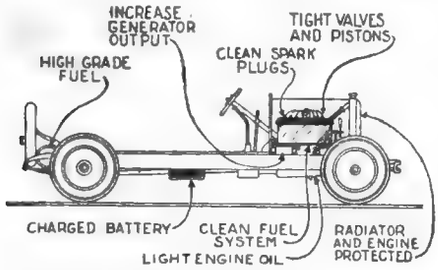
Conducted by GEORGE A. LUERS

A New Monthly Department Prepared by a Well-Known Automotive Engineer

AIDS TO QUICK STARTING ON FROSTY MORNING

NO single accessory is available for the engine, which will insure a positive start on a frosty morning, but such accessories as dash primers and electrical heaters combined with an engine in good mechanical shape and a driver with considerable practice, will get the engine going without much delay.

Assuming the engine is in condition, with tight valves and pistons, free from carbon and the spark plugs are clean, the owner



Starting aids for extreme cold:
—can of half ether and one-half gasoline for priming;
—woolen cloth around intake saturated with hot water;
—building brick heated and placed adjacent to carburetor.

Denatured, alcohol mixture to prevent engine from freezing:

Percentage	Lowest Temperature
10	24° above
20	16° above
30	7° above
40	2° below
50	8° below

should put the fuel and electrical system in good operating order for quick starting.

Fuel lines, sediment bulb, vacuum tank and the bowl of the carburetor, will collect water, which in freezing cuts off the gasoline supply.

Drain and clean out all sediment and refill, for winter use, with one of the better grades of gasoline mixtures. This gasoline costs a few cents more per gallon, but it saves a drain on the starter and gets the engine running more readily than will the poorer grades.

The lightest grade of oil, consistent with the manufacturers instructions, should be used in the engine. Do not simply add light oil to the old oil, drain, flush and refill the oil reservoir.

The storage battery should be as near fully charged as possible and to have this condition, the charging rate of the generator should be increased. The service station will usually change the charging rate of the generator without cost to the owner.

A good tight radiator and hood cover should be fitted over the engine, to keep off as much cold as possible.

Having observed the above precautions, the owner is prepared for a quick start, under average conditions.

The action of starting the engine, should proceed as follows. Turn the engine over about four times, by hand or starter, with the choker rod all the way out. Switch on the ignition, hold out the clutch and with the choker nearly all the way out, press the starter. Immediately the engine fires, press the choker back and almost as instantly pull it forward again, moving it back and forth quite as rapidly as possible. To pull it out fully will flood the engine and to push it back entirely starves the engine, so the best means is to pull it out with a series of jerks, until the engine ceases to balk.

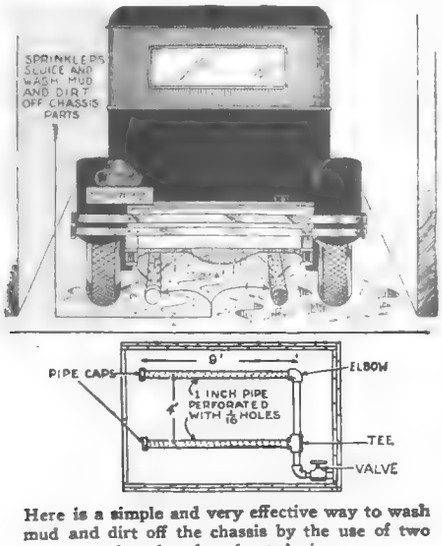
In zero temperature or lower, the owner will find a hot brick placed adjacent to the carburetor an aid, hot water is also of value, use this over a woolen cloth wrapped about the intake manifold.

Some owners, make it a practice to stop the engine by pulling out the choker. This fills the cylinders with gas, but it also dilutes the engine oil. If used, the oil should be changed each five or six hundred miles.

Park whenever possible, with the car headed down hill, and coast to a start. This saves the battery charge as will also less use of the bright headlights for long periods.

An ordinary oil can, filled with one half commercial ether and one half gasoline, with a cork over the spout to prevent evaporation, should be kept under the hood for an emergency. Use this to prime direct into the cylinders.

A frozen engine may start, but cannot be driven far, so take the precaution to add denatured alcohol to the radiator at the approach of cold weather. The proportions given in the chart will avoid freezing at the temperatures indicated.



Here is a simple and very effective way to wash mud and dirt off the chassis by the use of two lengths of perforated pipe.

PIPE SPRINKLERS TO CLEAR RUNNING GEAR OF MUD

Washing the car in the colder months, is under the best conditions, a disagreeable job. It is inadvisable to allow the accumulations of mud and wet dirt to remain on the chassis of the car, as this will rust up the various parts of the brake mechanism, the springs, steering gear, mud guards and running boards.

The pipe sprinklers shown in the attached sketch, is a simple and inexpensive means for avoiding the usual washing duties and allow of clearing off the chassis of the car, immediately that it is driven into the garage.

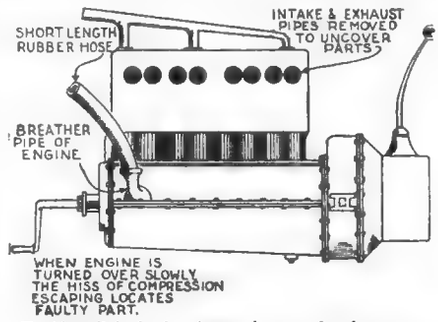
Two one inch sections of iron water pipe about nine feet long are placed in the center of the garage floor, about four feet apart. These pipes are perforated with one sixteenth inch drilled holes, and are connected with the water main or garage hydrant.

A valve to turn the water into these sprinklers is located in a protected position.

DETECTING COMPRESSION LEAKS

One of the discouraging details of car operation and maintainence, is that of making a correction in mechanical parts, only to find on completion, that the electrical part of the engine was the primary cause.

As an example of a specific case, only recently one owner had new rings put on a piston, and immediately on top of this had the cylinder bore ground out, fitted a new piston and special rings. The real trouble was in a worn cam operating the breaker mechanism, one point of the cam being worn down so that the spark was very intermittent in the one cylinder.


INTAKE & EXHAUST PIPES REMOVED TO UNCOVER PARTS
SHORT LENGTH RUBBER HOSE
BREATHER PIPE OF ENGINE
WHEN ENGINE IS TURNED OVER SLOWLY THE HISS OF COMPRESSION ESCAPING LOCATES FAULTY PART.

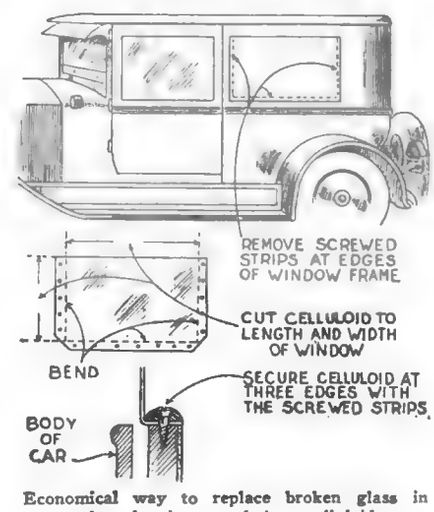
To "hear" leaks in piston rings and valves, you listen at the end of the rubber hose connected with the breather pipe.

If a leaking piston or a bad valve is suspected, it is a simple matter to detect these before tearing down the entire engine, and much labor and expense is avoided, if the trouble is found to be electrical, through this check up on the pistons and valves.

The sketch shows the process of checking up, for which purpose a length of hose, inserted in the engine breather is needed.

Place this hose to the ear while the engine is turned over by hand slowly and a loud hiss will tell if the rings on any one piston are stuck, worn or broken.

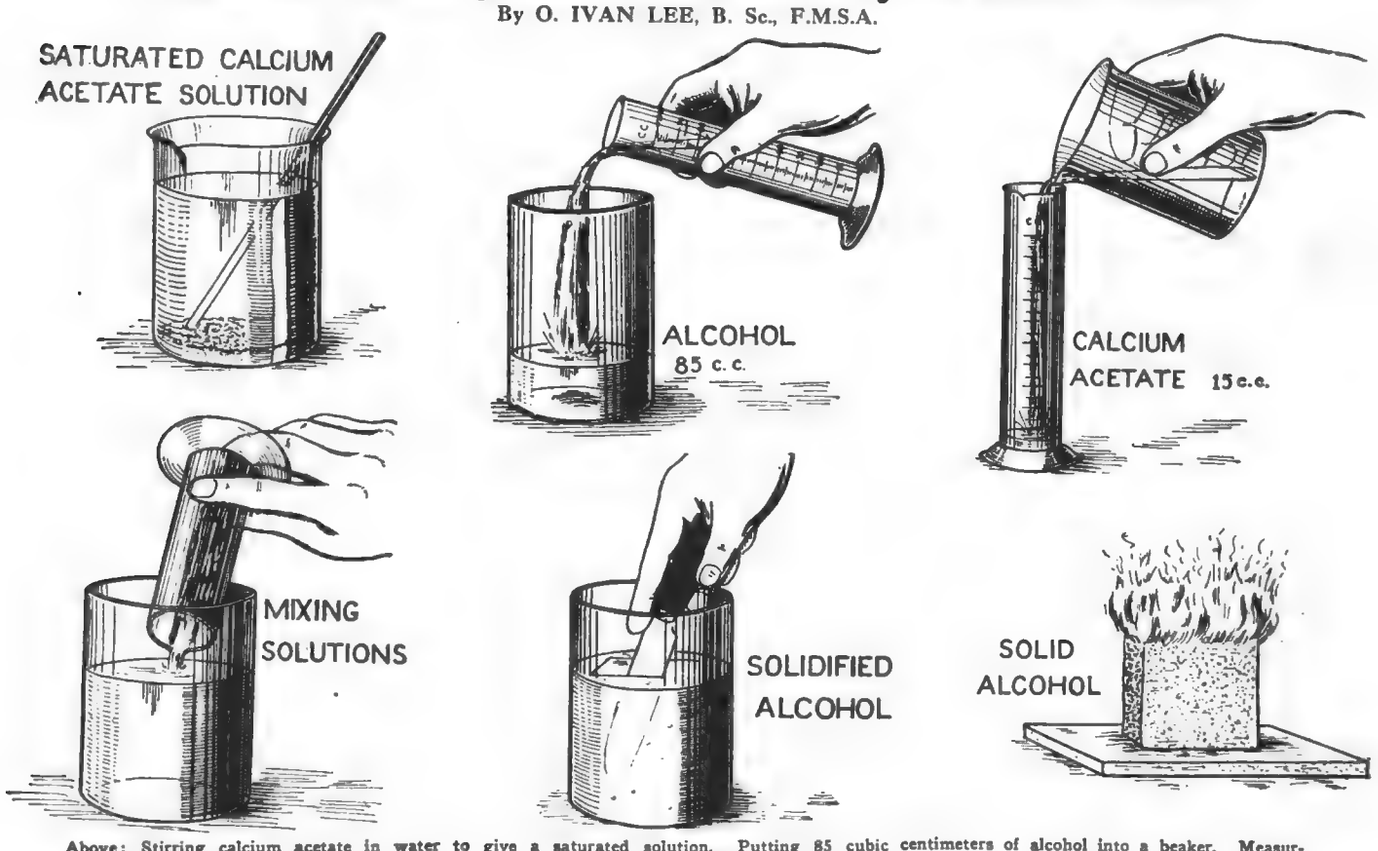
(*Continued on page* 663)


REMOVE SCREWED STRIPS AT EDGES OF WINDOW FRAME
CUT CELLULOID TO LENGTH AND WIDTH OF WINDOW
BEND
SECURE CELLULOID AT THREE EDGES WITH THE SCREWED STRIPS
BODY OF CAR

Economical way to replace broken glass in sedans by the use of sheet celluloid.

How to Solidify Alcohol Instantly Without Heat

By O. IVAN LEE, B. Sc., F.M.S.A.



Above: Stirring calcium acetate in water to give a saturated solution. Putting 85 cubic centimeters of alcohol into a beaker. Measuring 15 cubic centimeters of the calcium acetate solution.

Below: Pouring the 15 cubic centimeters of calcium acetate solution into the alcohol. The liquids solidify and a piece can be cut out with a knife. Burning the piece of solidified alcohol.

MAKE a saturated solution of calcium acetate by dissolving one ounce of the acetate in three ounces of water; allow to settle or filter to obtain a clear solution.

Measure 85 cc. of denatured alcohol with a graduated cylinder and pour it into a glass.

After washing out the graduated cylinder with water, measure 15 cc. of the saturated calcium acetate solution into it.

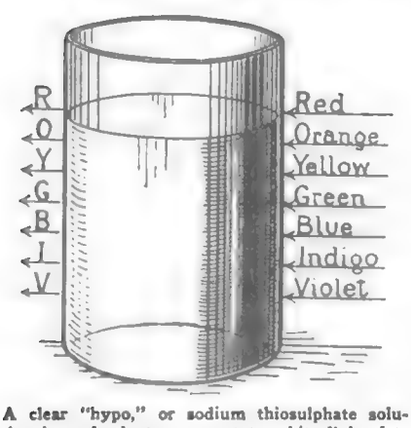
Dump the 15 cc. of saturated calcium acetate *quickly* into the 85 cc. of denatured alcohol, giving the whole a *quick* swirl or stir to mix the two solutions.

Instantly, the alcohol will solidify to an opalescent mass as hard as soap! The glass may be at once inverted without spilling a drop. With a sharp knife, cut out a cube from the center of the mass.

To prove that this material is really solid alcohol, place the cube on a piece of plasterboard. On applying a lighted match, the cube will burn with a smokeless flame and intense heat.

Why Sunsets Are Red

By O. Ivan Lee, B. Sc., F.M.S.A.



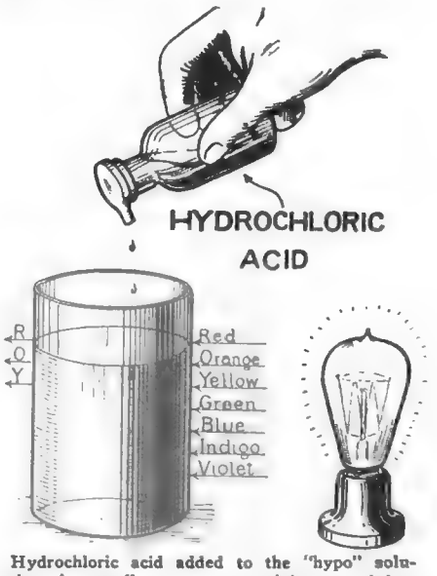
A clear "hypo," or sodium thiosulphate solution is perfectly transparent to white light, letting all the colors of the spectrum pass through it.

THE predominating yellow orange and red colors of sunset are due to the absorption of the shorter wavelengths of violet, blue and green from white by the thick layer of suspended dust, smoke and moisture particles intervening between the sun and the observer at this time of day. This effect may be duplicated by the following striking chemical experiment.

A Chemical Sunset Effect

Dissolve a teaspoonful of photographer's "hypo" (sodium thiosulphate) in a glass of water and view the solution against a strong light which will appear undiminished in brightness and unchanged in color. In other words, all the colors in white light are transmitted.

Now add a little hydrochloric acid (a few drops should be sufficient). In a short time, the clear, colorless solution will become clouded, then milky and finally opalescent and opaque from the precipitation of finely divided white sulfur. The light will appear dimmed, then yellow, orange, red; at last the colors will be extinguished as the particles of sulfur become more numerous and larger.



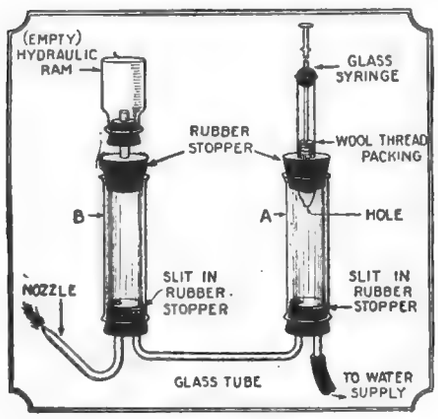
Hydrochloric acid added to the "hypo" solution in small amounts precipitates sulphur and only light of longer wavelengths passes through it.

Model Force Pump

By RAYMOND B. WAILES

THIS little model force pump is made from ordinary glass tubing and rubber stoppers, a glass medicine syringe and a short length of rubber tubing; all except the syringe are regular laboratory supplies. The principle of the lift and the force pump is clearly shown when it is in operation, for the little flap valves which are made with the rubber stoppers can be clearly seen opening and closing when the piston of the syringe is operated. Then too, the operation and purpose of the hydraulic ram is also shown.

The flap valves are the secrets of the whole apparatus. They are made by slitting parallel to its flat face a very soft unperforated rubber stopper, with a razor blade as shown in the drawing. The razor blade must be wet to give a good cutting action. The flap should be about a sixteenth of an inch in thickness. The inlet tube to this valve is passed through a hole in the stopper, which ends just under the flap of the valve. The outlet tube is thrust through a hole bored completely through the stopper. Cork borers such as are used in chemical laboratories will make a very clean hole through



A chemist's model of a force pump using only the tubes and perforated stoppers found in the laboratory and a glass syringe.

the rubber stoppers. Wet them before using. A solution of sodium or potassium hydroxide is better than water.

It will be seen from Fig. 1 that an upstroke of the piston of the syringe will suck water through the right hand tube into chamber A, and on the down stroke, the pressure exerted will close the flap valve through which the water entered, and at the same time will force the water now in the chamber A, into the chamber B, entering it through the flap valve in that chamber. Another up stroke will suck in more water, etc. Soon the water will be issuing from the nozzle in a somewhat jerky stream—if the little bottle which acts as an equalizer is not attached to the top of chamber B. With this pump, water can be thrown several feet up into the air and if the piston be given the right "timing," and the empty bottle added, the stream of water will be very steady.

Care should be taken so as not to allow the flaps of the valves to rub against the sides of the glass chambers, as this will impair their action.

Only soft, fresh rubber stoppers should be used.

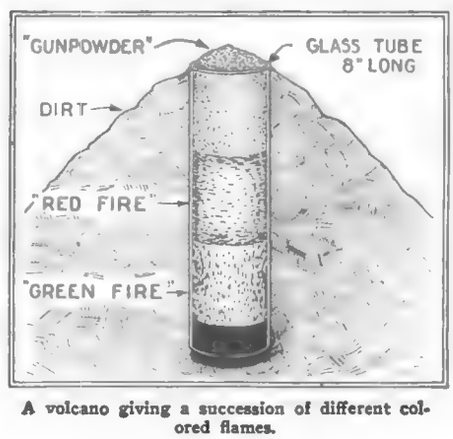
How the chemist's model force pump appears when mounted.

How to Make a Miniature Volcano

To make this miniature volcano you will need first the following chemicals:

Barium nitrate,
Calcium carbonate powder or strontium nitrate,
Potassium chlorate,
Sulphur.
Powdered charcoal
and Potassium or Sodium nitrate.

In mixing these chemicals you will make three different mixtures.



A volcano giving a succession of different colored flames.

The first is the "green fire," this is made by mixing 3 grams of pulverized potassium chlorate with 8 grams of powdered barium nitrate and 3 grams of powdered sulphur. Mix, do not grind together or you will have a dangerous explosion.

The second is the "red fire" and is made by mixing 1 gram of powdered potassium chlorate with 11 grams of calcium carbonate powder or strontium nitrate 4 grams of sulphur and ½ gram of lamp black.

The third mixture is gunpowder, and is made by mixing 15 grams of potassium nitrate with 2½ grams each powdered sulphur and charcoal.

A hard glass tube about eight inches long is fitted with a cork stopper at one end, the tube is then placed upright and dirt piled around it as shown.

The tube is then filled with equal parts of the three mixtures. The gunpowder is put in last.

After everything is ready the gunpowder is lighted with a long wax taper. The gunpowder will burn vigorously sending out sparks and a dense smoke. When the other two mixtures are reached the flame will turn red and then green.

KENNETH HANIFAN,
Waterville, Ohio.

A Graduate

MANY experimenters have need of a measuring glass, but these are quite expensive. Here is one which needs only a large test tube, a round piece of glass (plate glass), some hydrofluoric acid, and some of the experimenter's time.

The first thing to do is to get a large test tube, the larger the better. On this test tube, heat the bottom until the glass is soft, and make the bottom of the tube flat. This

Flattening the end of a test tube preparatory to mounting it on a foot to serve as a graduate or measuring cylinder.

can be done by pressure against a piece of asbestos lying on the tube. Next get a measuring pipette which can be bought anywhere for a few cents. After measuring the amounts required make a nick in the place with a file. Then cork the tube and dip it in paraffin. Scratch the lines and numbers in it and etch it in hydrofluoric acid. After it is etched deep enough, dry it and set it aside.

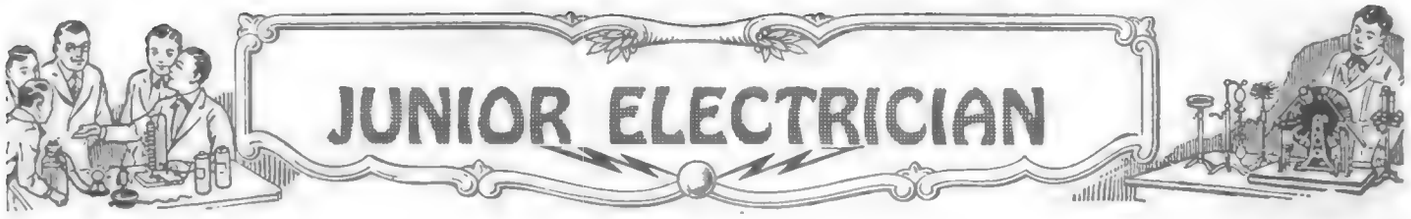
The next thing is a piece of glass for the foot—ground on a sandstone. It should be round and big enough in diameter to support the test tube upright.

Cement the test tube and the standard together with a glass cement made of 3 oz. of gum shellac, dissolved in the minimum amount of alcohol over a water bath. Be very careful to have a low flame. It is safer to use an immersion heater. One oz. of pure gum rubber is dissolved in a similar amount of ether. The two solutions are mixed together and kept in a tightly stoppered bottle. Caution ether is very combustible and its vapor mixed with air is explosive.

This glue successfully resists the action of both hot and cold water and of all ordinary chemical solutions. I have made one of these graduates and it is as good as a high-priced one.

A simple way to make the foot is to bore a hole in a block of wood. The hole must be larger in diameter than the test tube. Set it in the hole with plaster of Paris. Do not bore the hole all the way through.

—Contributed by Wm. Reinovsky.



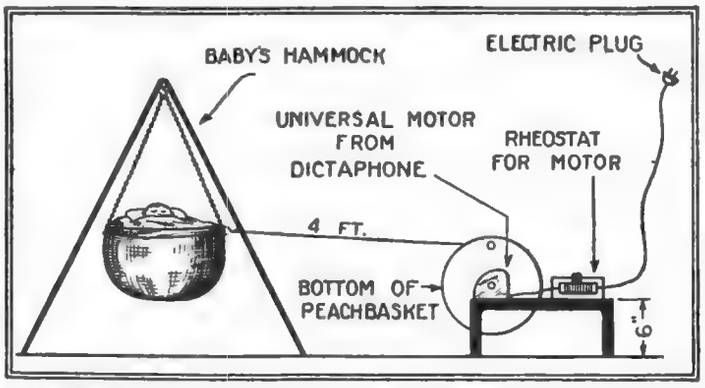
Electric Cradle Rocker

By HENRY W. BECKWITH

AT the present time the rocking of a baby's cradle is rather disapproved of, because when the inmate becomes accustomed to it, the little tyrant will not sleep without it. In such a case electricity comes to the rescue, just as it is coming to the rescue now for washing clothes, washing dishes, and getting rid of the old time ice-man.

The illustration shows a very simple connection for rocking a cradle by electricity. A universal motor is taken from an old dictaphone and this is mounted as shown, on whose protruding shaft a crank effect is produced, by attaching thereto a disc of wood such as the bottom of a 16-quart peach basket, with a crank-pin attached. Between the motor and service line a proper rheostat is placed.

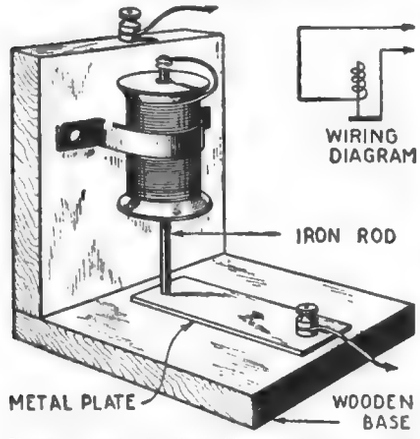
The hammock or cradle, as the case may be, is placed about four feet distant from the motor, and the wire from the cradle is attached to a pin projecting outward from the basket bottom or wooden disc. The distance of the pin from the center can be made to regulate the arc of the swing, or another very good way is to connect the wires to the pin by a slotted opening, so that the motor will only affect it during a portion of its rotation.



The family can go to the movies with clear conscience now, and with no fear that baby is going to wake up and yell for help. This adaptation of a dictaphone motor to domestic use makes it certain baby's hammock will be rocked without discomfort to the rest of the family.

In swinging the punkahs or fans used in India, the great point was for the coolie to time impulses exactly to the natural period of oscillation of the fan, and this has to be done for our cradle swinging. There may be a certain amount of difficulty in getting the exact timing, but once this is secured, everything goes on with wonderful smoothness. It will be understood that the motor only gives a pull to the cradle, and it will be seen how necessary it is therefore that the pull be given at the right instant, a somewhat difficult point to ensure.

Simple Circuit Breaker



Simple circuit breaker illustrated above will serve very nicely to interrupt the circuit when the flow of current reaches too high a value. The iron rod fits rather tightly into the spool so that it is held up after contact has been broken.

First a wooden spool is wound with magnet wire. The amount of wire used and its size will depend upon the use for which the circuit-breaker is intended. For heavy currents use large wire and for lighter currents use smaller wire.

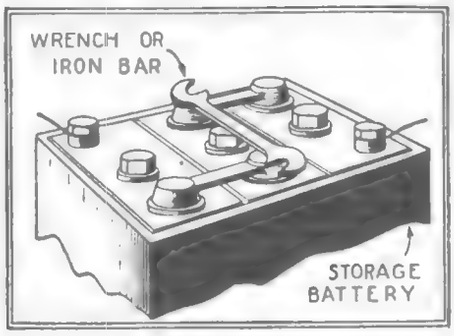
The spool is mounted on a wooden stand and a little metal plate is placed at the bottom of the stand. A small iron rod extends through the spool and makes a contact with the metal plate.

The diagram of connections is given. When too much current is flowing through the device, the magnetic force will draw the iron up into the center of the spool and the circuit will be broken.

As a magnet the arrangement is inefficient, but it is an excellent circuit-breaker.

Contributed by J. H. Ivers.

Dead Battery Cell



If one cell of a storage battery goes bad under embarrassing circumstances, the motor may usually be started if the bad cell is shorted out by a wrench laid across its terminals.

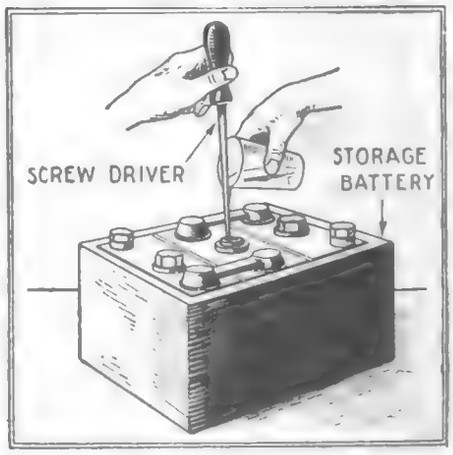
When a cell of the battery goes dead while you are camping or touring, look for the dead cell first. After it is found, place an iron bar or wrench across and firmly in contact with the posts of the dead cell, then press the starter button. The stunt closes the circuit of the live cells and furnishes enough current to start the motor.

Contributed by E. F. Matheson.

Electrical Articles Wanted!!

Write up your favorite electrical stunt and send it to the editors. Pencil or pen and ink sketches are sufficient. All articles published will be paid for at regular rates.

Watering the Battery



An emergency device for pouring a liquid through a small aperture may be improvised as shown in the above drawing. Its utility is not confined to filling the storage battery, as it works with all liquids.

When the funnel has been left at home, an easy way to fill the storage battery is to place a screw driver directly in line with the hole and pour the water slowly down the shank. The water is then guided directly into the battery without spilling. Do not on any account do this with acid as it will attack the screw driver and contaminate the battery fluid. If a paper drinking cup is handy, remove the bottom, slit down the side and roll to form a cornucopia, leaving a small hole at the bottom, and use as a funnel instead of using the screw driver. This can be used for acid. An emergency funnel, thus made is also handy for pouring oil into the crank case when on a trip, if you carry your own oil.

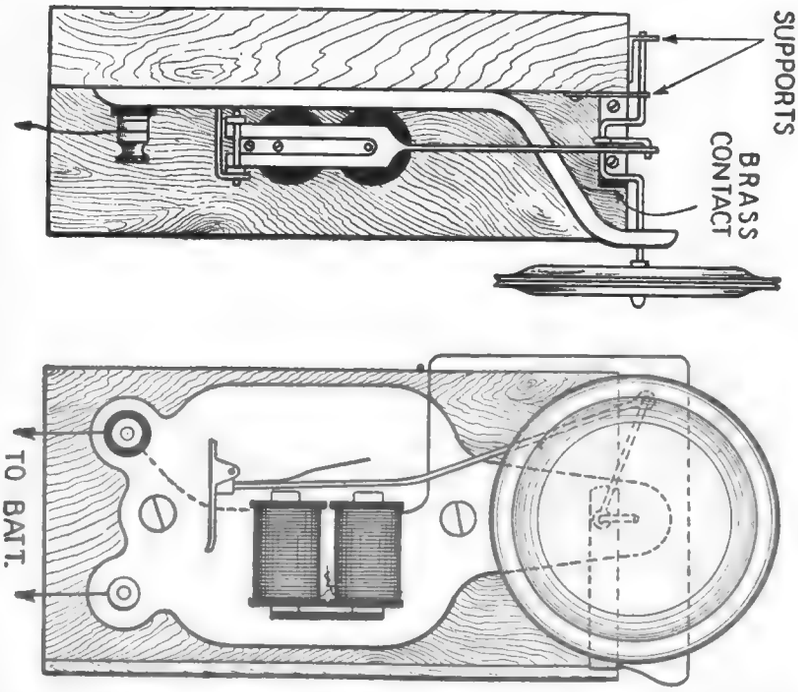
Contributed by E. F. Matheson.

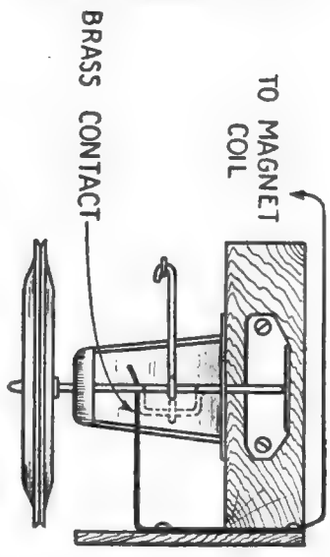
Motor Made from An Electric Bell

By JOSE MATA

THE illustration shows a very simple motor constructed from an electric bell. These bells are made to be operated by three or four dry cells, but in a properly regulated household, a bell transformer is always included in the electrical equipment, and from this the bells are run and the motor can be operated.

The drawing of the motor speaks for itself. The armature contact or spring attached to the armature is not used. In its place the make and break is given by a flat spring indicated by the words "brass contact" which bears sideways against the arm of the crank. The crank is made of wire and carries some kind of extemporized fly wheel on its outer end and the little supports for the wire shaft are secured to the woodwork to which what is left of the bell is attached.

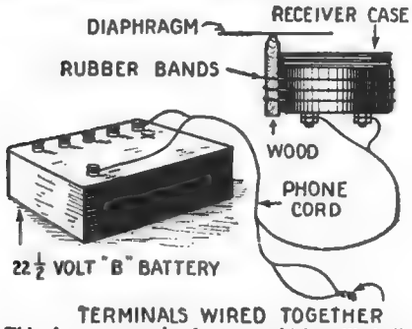




A discarded electric bell may be made into an interesting toy motor by substituting a drive mechanism for the clapper. The wheel should be sufficiently heavy so that its inertia will keep the mechanism in motion.

It will be observed that one of the binding posts is insulated by a thick washer and bushing from the frame of the bell, while the other binding post is not insulated and makes contact with the crank.

Testing Polarity of Telephone



This is a very simple test which will indicate the polarity of a headphone or loud talker unit without involved tests.

IT is of course advisable to always connect your receivers in the circuit in such a manner that the direct current will flow through the magnet coils in proper direction to aid or reinforce the permanent magnets. If the polarity of the receiver is lost it may be easily found and marked again. Remove the cap and diaphragm in question and sensitively balance the diaphragm to one side about ¼ or ½ inch (depending on the strength of the permanent magnets) above the receiver case as shown.

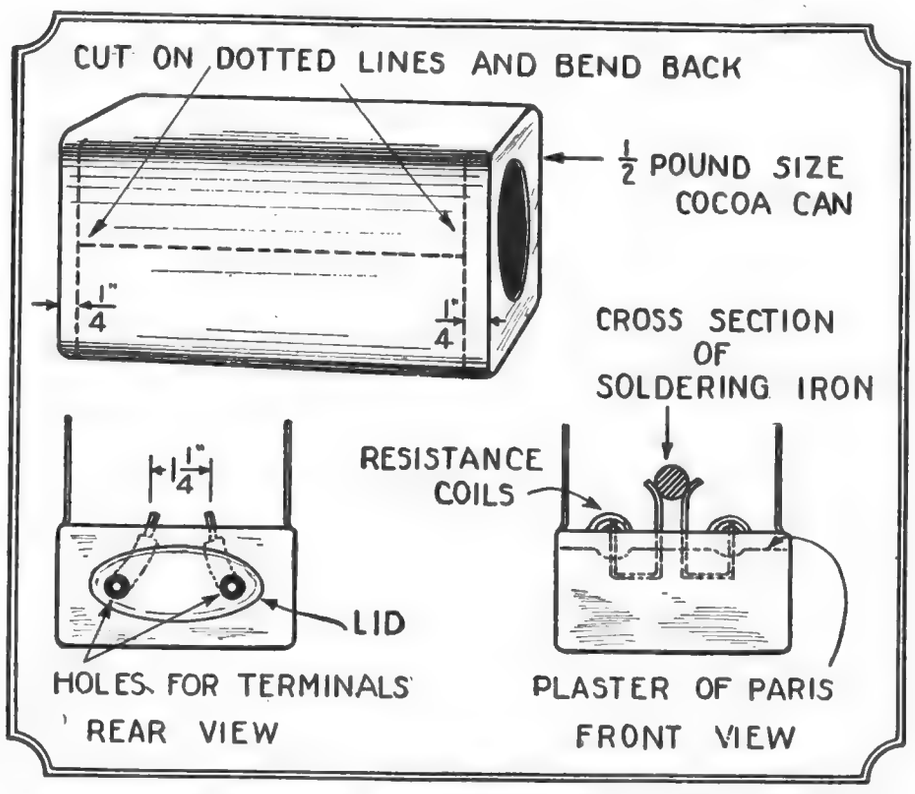
Flexible leads are run from the receiver to a 22½-volt "B" battery with whose terminals they should remain in contact only a second, in order not to do damage to the phones or run down the battery. For the flexible leads the regular phone cord is very convenient if used as shown. As soon as the connection to the battery is made the diaphragm will tilt to or from the magnets depending upon whether the current is flowing in such direction as to aid or weaken the permanent magnets. Select and mark that polarity which tilts the diaphragm toward the magnets and reassemble the receiver by placing the diaphragm and cap in place. Always place the diaphragm over the magnets with the black side up.

Contributed by Eldon Faspaugh.

Simple Electric Furnace

It is an electric furnace which can be made in an hour by anyone and can be used to heat the soldering iron (if the electric iron is burned out, like mine), and at the same time it will heat a can of paraffin, glue, shellac or any other substance. The furnace is brought into action when the iron is laid upon it, which closes the circuit and when the iron is removed the circuit is opened.

The necessary materials to build the furnace are: ½ lb. size cocoa can, 2 lb. plaster of Paris, 25c worth of heating element No. 26 resistance wire, 10 inches of insulated wire, No. 10 or No. 12 will do. This furnace is so arranged that when one coil burns out it can easily be replaced. The total cost will be about 30 cents and no special mechanical ability is needed.

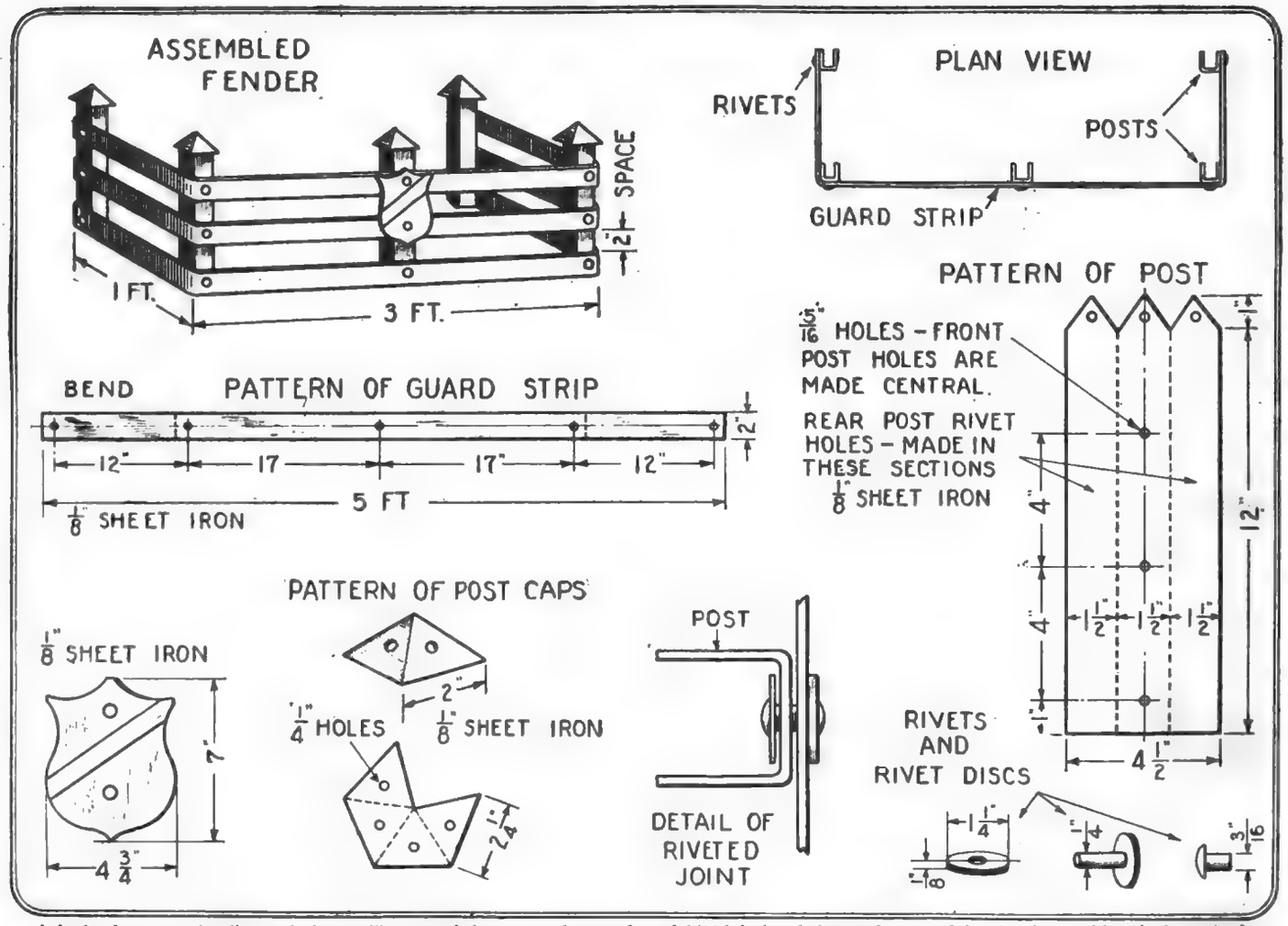


A very simple electric furnace which may be used for small tasks such as heating a soldering iron may be easily made from a one-half pound cocoa can. Resistance coils are imbedded in a plaster of Paris base and contact is made by the iron itself as shown above.

THE CONSTRUCTOR

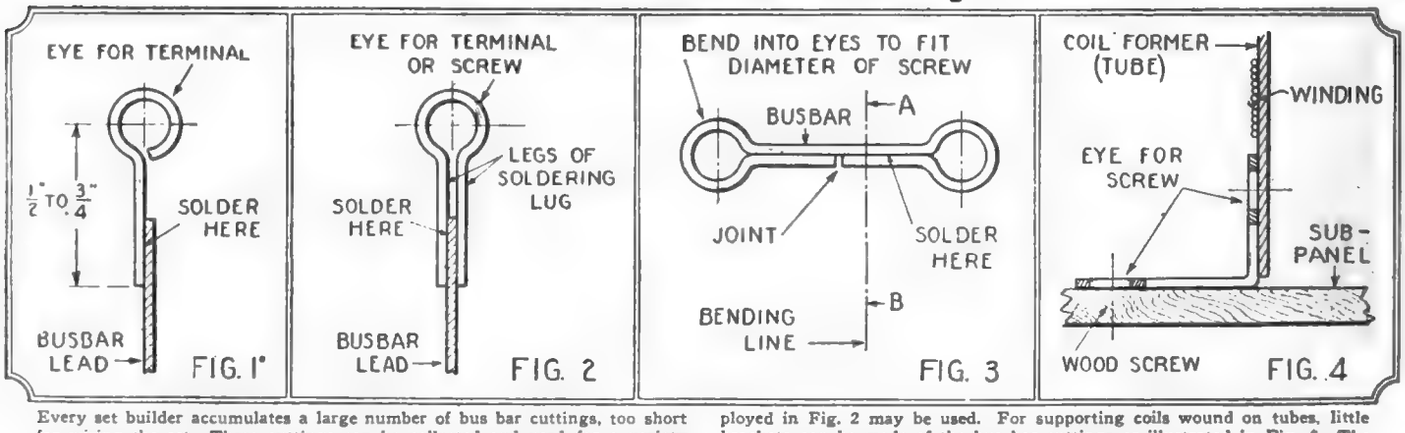
Fender for Colonial Fireplace

By GEORGE ARTHUR LUERS



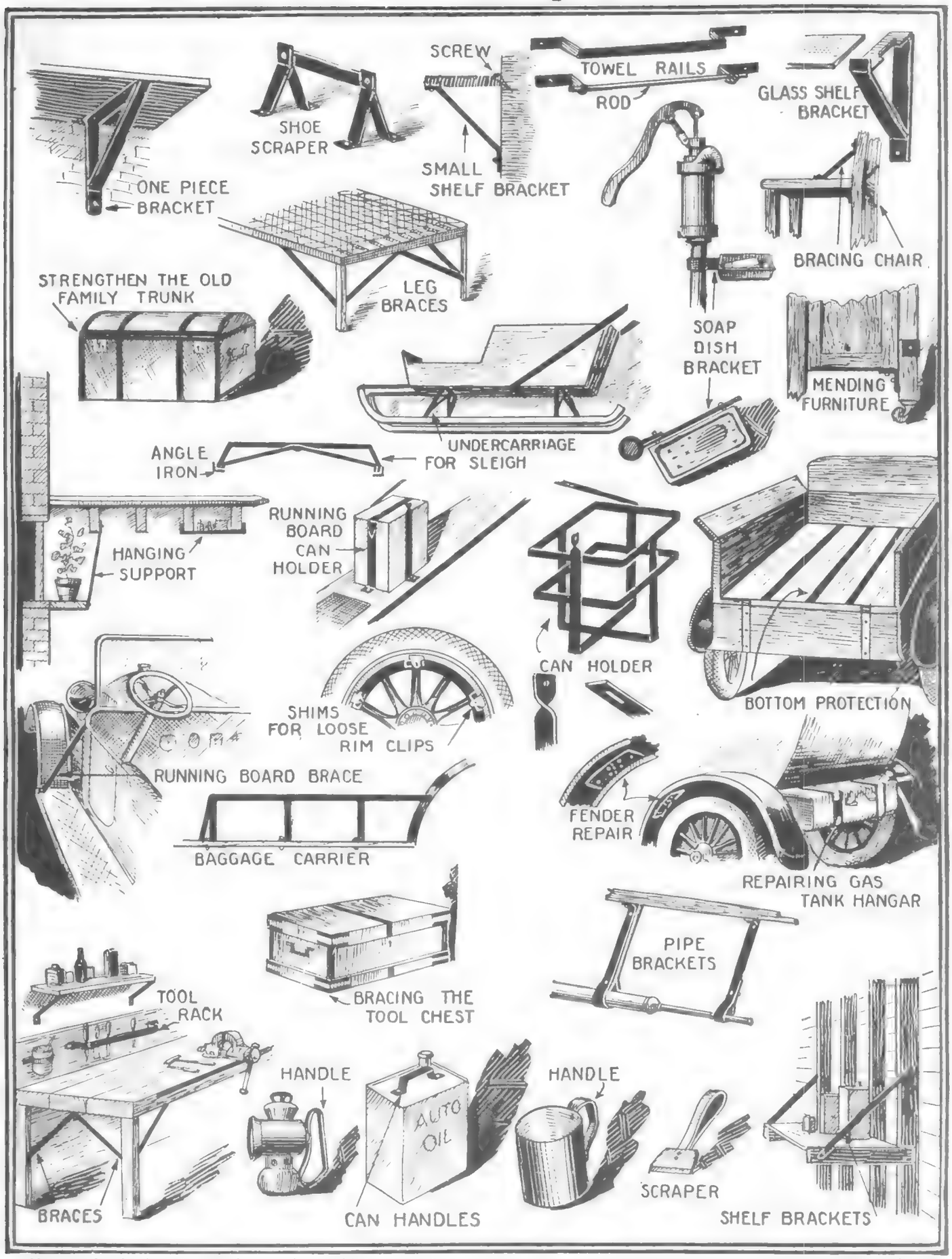
A fender for preventing live coals from rolling out of the protected area of the hearth is illustrated here and the method of its construction is also shown. Three lengths, (5 feet) of strip sheet iron 2 inches wide and 1/8-inch thick form the guard strips. Five pieces, 4½ inches wide and 14 inches long of the same thickness form the posts and 5 pieces 4 inches square are used for the post tops. In addition, 1 foot of ¼-inch soft iron rod and 6 inches of 3/16th-inch soft iron rod are used for the rivets, although these can be purchased if desired. The surface of the iron should be planished with the flat of a heavy hammer against the surface of an anvil to destroy the rolling marks. The work may be finished with stove pipe enamel or left raw as desired. If the builder understands the work, an oxidized finish may be easily produced.

Uses for Bus Bar Scrap



Every set builder accumulates a large number of bus bar cuttings, too short for wiring the set. These cuttings can be collected and used for a variety of purposes. One of them is the making of small lugs to fit binding post terminals. This is shown in Fig. 1. For a stronger grip, the method employed in Fig. 2 may be used. For supporting coils wound on tubes, little brackets can be made of the bus bar cuttings as illustrated in Fig. 3. The bracket should be bent along the line AB and the two openings provided, are for the coil and the sub-panel.—C. R. Oldroyd, Rep. No. 4433.

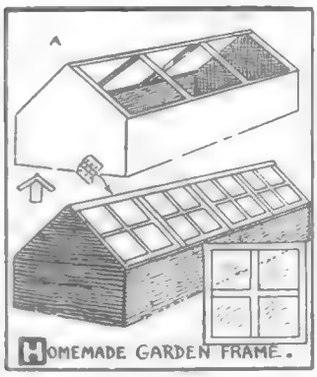
Uses for Strap Iron



Above are found quite a few uses for strap iron, which is usually thrown away. Strap iron is generally used for binding sheet metal sent to tinsmiths and may be ordinarily obtained for the asking. The pieces run about three feet long and are in various thicknesses, making them suitable for many different jobs. The tools which are necessary are a breast drill, a file, a hack-saw, a ball peen hammer, a center punch and a soldering iron. In addition, an assortment of iron rivets, stove bolts and a vice will prove quite necessary.—Eric B. Roberts, Reporter No. 15197.

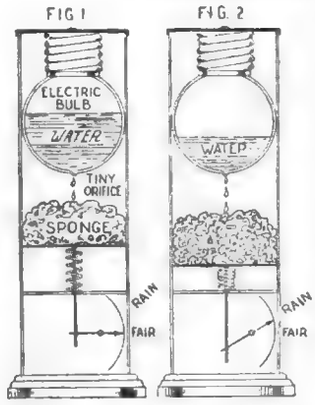
HOW TO MAKE IT

GARDEN FRAME



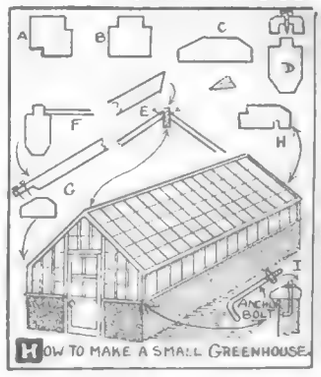
A very good garden frame can be made from old window sashes as illustrated. One by twelve lumber makes the frame and the sashes are hinged to it. Hot manure covered with soil produces the heat.—T. Sheward.

HYDROMETER



A practical hydrometer can be constructed with the aid of an electric bulb, a sponge, a spring and a needle marker. When atmospheric pressure is low, the water inside the bulb drops on the sponge, changing the needle reading. —Eduardo Delgado.

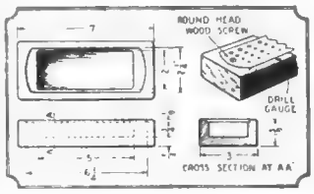
GREEN HOUSE



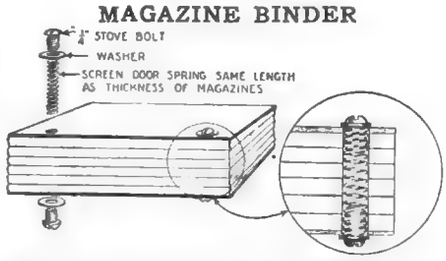
The illustration here shows how a small green house can be constructed. The scantling to support the eaves is shown at A. C is a sill and D shows the cap for the glass. The drawing indicates how the construction is developed.—T. Sheward.

DRILL CASE

By making a small wooden box to the top of which a drill gauge is screwed, a case for the transportation of drills is obtained. —Frederic William Theiman.

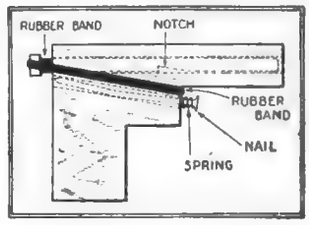


MAGAZINE BINDER



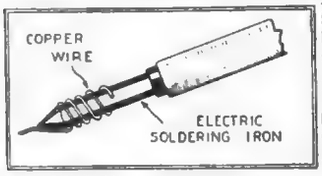
An ideal loose-leaf binder for magazines may be made from two pieces of beaver board or heavy cardboard. Two short pieces of screen door spring of the same length as the thickness of the twelve magazines and two ¼-inch stove bolts. The holes are punched into the magazines with a ⅜-inch belt punch and the screws are turned down into the spring. The magazines will open flat when in use. —Forrest K. Green, Rep. No. 25668.

RUBBER BAND GUN



The illustration here indicates the construction of a rubber band gun from a nail, a piece of wood and a band.—Author please send address.

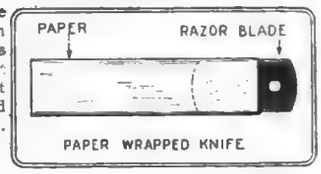
LEATHER BURNING



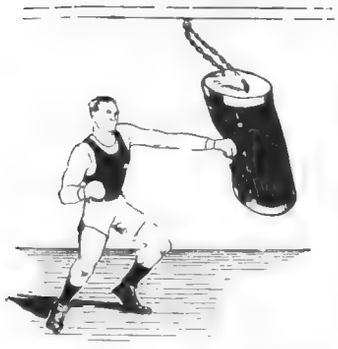
An ideal outfit for burning leather may be nade with an electric soldering iron and a piece of twisted copper wire.—Joseph Liebowitz.

PAPER KNIFE

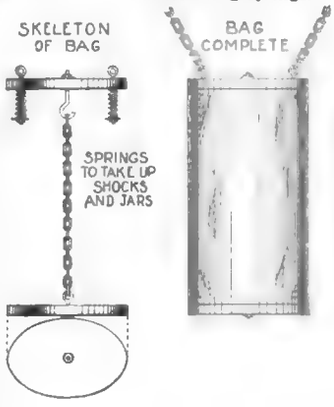
A razor blade wrapped with paper makes this knife. It will not cut through glued paper handle. —Francisco Luna.



PUNCHING BAG

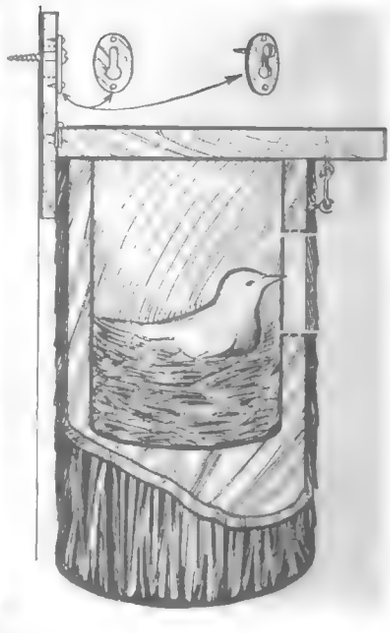


The life of a punching bag as used in all gymnasiums and boxing clubs is invariably short, owing to the weight of the bag being entirely supported by the outer covering. In the bag shown in this illustration the weight is supported by a chain adjustable at the top of the bag. The rings by which the bag is supported have shock-absorbing springs.



The top and bottom of the bag are oval-shaped pieces of 2 by 12 inch board glued together to form a piece 12 inches wide and 18 inches long. A canvas covering is tacked around the pieces and a leather strip is nailed over the ends of the bag. The bag is filled with cotton-seed hulls. After filling, the nut at the top is tightened to take up the weight. —Thomas F. Johnson.

EASILY BUILT BIRD HOUSE

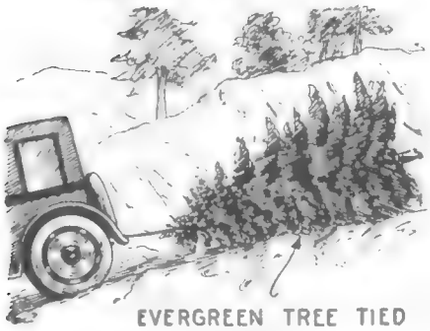


In many parks birds are enjoying a luxuriously easy life, being spared of the trouble of building a home. The photograph above and the illustration at the right shows the construction of one of these bird's nests. Note the improvised catches to hold the nests in place.

WRINKLES
RECIPES & FORMULAS

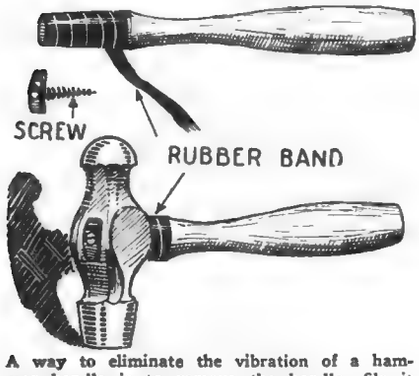
Edited by S. Gernsback

EMERGENCY BRAKE



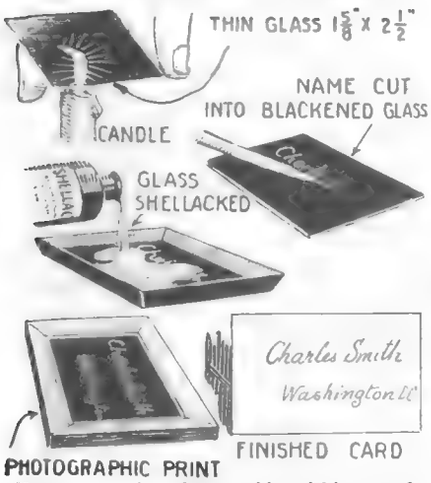
Should you be travelling through a hilly country where garages are unknown, and should your brake linings wear out while miles away from a garage, an emergency brake can be formed from an evergreen tree. Simply cut the tree and tie it to the rear axle and about two feet from it.—H. H. McLean.

SHOCK ABSORBER



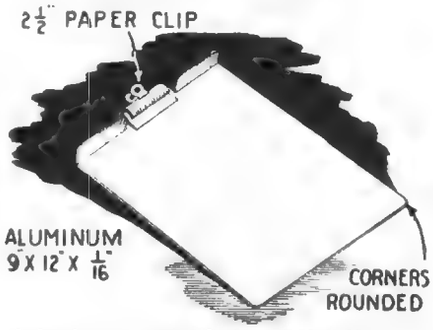
A way to eliminate the vibration of a hammer handle is to remove the handle, file it down so that it is about an eighth of an inch smaller than the slot and wind rubber bands around the handle as shown. A washer and screw holds the handle in place.—Nina Jeffers.

PHOTOGRAPHIC CARDS



You can make photographic visiting cards without the aid of a camera as follows. Blacken a sheet of glass, sign your name, fix with shellac and use with regular photographic paper in a printing frame. The card should be developed.—D. R. Hoag.

PAPER HOLDER

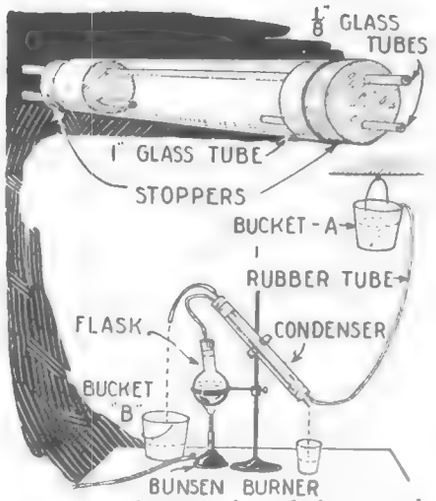


A handy note paper backing and holder can be made from a sheet of aluminum. The top of the sheet is divided in three parts as illustrated, and the outside ends are turned up at right angles to the main sheet. A regular paper clip is affixed to the center part as shown.—L. M. Curtis.

BURGLAR ALARM

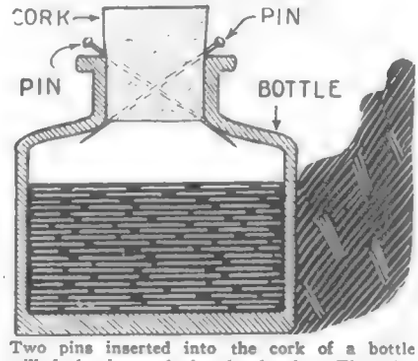
To make a burglar alarm, select a large glass sheet and cover this with tinfoil which may be shellacked in place. The letters are cut out and then an electric lamp is mounted behind the sheet. The wires to the lamp lead to a switch in the master's bed room. Author please send address.

DISTILLING APPARATUS



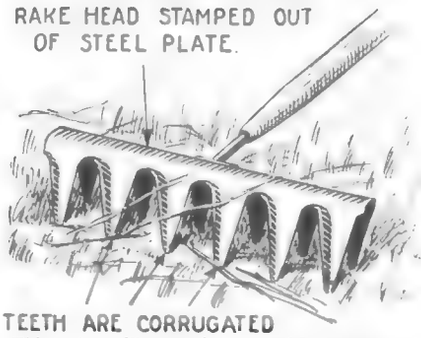
A simple condenser can be made from several glass tubes and a couple of corks. The details of the construction are illustrated above. It may sometimes be difficult to get a supply of running water for the still so the method outlined will furnish it. When bucket A, is nearly empty, the tube is pinched and bucket B, is substituted for A.—Wilburn and Baugh.

BOTTLE LOCK



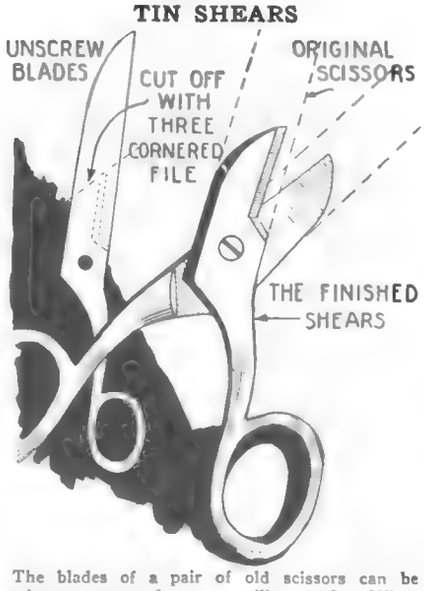
Two pins inserted into the cork of a bottle will lock the cork in the bottle. The pins prevent the contents of the bottle from forcing the cork out if the bottle should be accidently overturned. Taking poison accidentally can also be prevented in this manner.—Earl R. Stevens, Rep. No. 25284.

GARDEN RAKE



This rake will not clog up with stones and other refuse due to its two sets of teeth. The rake is particularly adaptable to gardening and lawn cultivation as the teeth strike out at different angles. The device is obtainable on the market.—Allen P. Child.

TIN SHEARS



The blades of a pair of old scissors can be taken apart and cut as illustrated. When joined together again an excellent pair of shears for cutting tin and other materials will be formed. This type of construction will be found better than a cheap pair of tinners' shears.—Juan Estolas.

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

ACCORDING TO S & I DATA

Editor, SCIENCE AND INVENTION:

I have been a reader of your wonderful magazine a good while, but the best thing I have seen for a long time is "The Last Stage Amplifier" by R. L. Young. I made it from an old Ford Spark Coil, and it works perfectly. I have it connected to a five tube set and the music from WJZ can be heard three blocks away in the daytime.

HERBERT L. TRAYLOR, JR.
Suffolk, Va.

(We are glad to get comments on the construction of sets or equipment from data in S. and I. and appreciate this type of letter at all times, even though we cannot publish them all because of limited space. We thank you.—EDITOR).

THE SUN'S HEAT

Editor, SCIENCE AND INVENTION:

What source do we get our heat from? Is it from the sun or otherwise?

After deliberating on the subject for a while, I decided that we did not get our heat from the sun (at least not directly) and for the following reason. We know according to scientists that if we reach a height of about 500 miles we reach a perfect vacuum. Now we know from experiment that neither heat nor cold can pass through a vacuum. Therefore, we do not get our heat from the sun directly, although I don't see any other way in which we can get our heat. Can you explain this?

Would like to know if there is anything like light without heat. With best wishes for the success of your new magazin AMAZING STORIES, I remain

MURRAY GOLD,
Brooklyn, N. Y.

(SCIENCE AND INVENTION *Magazine has repeatedly explained how this earth derives its heat from the sun. Heat is distributed by three methods, conduction, convection and radiation. In the form of heat distributed by conduction, the molecules of the substance transfer the heat. We know that cloth or paper may be safely used to pick up warm metals and that cooking pots and utensils are frequently provided with wooden handles. This is because the metal conducts the heat far more readily than wood. Practically, the principle of the conduction of heat is employed from a stove to flat-irons, through the bottom of a kettle on the stove to the water inside and from any one conducting substance to another.*

When we hold our hands over a radiator we feel the warm air about them. Light objects like feathers or paper will rise up over the radiator. Also the water in a kettle after a while will be warm all over even though heat is being applied only to the bottom surface of the kettle. This is what is termed the convection of heat and the air currents or the water currents carry the heat through the entire substance. Convection is therefore the transfer of heat by moving currents of a fluid which fluid may also be a gas. This is the chief method of distributing heat in a room and distributing the heat through a body of liquid. Cold is also similarly distributed in the ice box. Note that in the ice box the ice is placed on the top because the cold air passes downward whereas in a room the fire is at the bottom of the room to permit the hot air to rise.

The third form of heat is the heat by radiation. All bodies that are warmer than their surroundings tend to lose heat and colder bodies will gain heat by this method. If you sit in front of an open fireplace or in front of a radiant electric heater, your face will become uncomfortably warm. If you take a fan and shade your face you will feel cool again. The reason for this is that you have cut off the radiant rays of heat. There is little if any convecton heat which has been cut off by the fan. Sitting in the shade involves the cutting off the sun's radiant heat.

The sun gives this planet its heat and that heat is radiant in nature. On striking the earth's surface, the radiant heat warms up the surface of the earth, which in turn heats the surrounding atmosphere. In addition to that, the radiant heat also heats the atmospheric envelope, particularly the water particles in the air. Radiant heat must always be intercepted by a body before it can be felt or recorded. The earth's atmospheric envelope will retain the heat so delivered for a considerable length of time and consequently our nights are frequently warm. If the earth had no atmosphere, then the vegetation would burn up in the daytime due to the terrific amount of heat and at night everything would freeze over. The earth itself would be hot for a short time if it were without an atmosphere, but this heat would be given off into space very rapidly. A man standing on an atmosphereless earth would find his feet uncomfortably warm, while his body would be freezingly cold.

The expression "radiant heat" is used very often to specify ether waves. Ether waves pass through space and pass through many bodies such as glass, heating them somewhat as they pass through them, expending on them, therefore, part of their energy and heating any other body which they impinge upon, thus converting the ether waves into molecular motion, or kinetic heating.

Space is charged we may say with electro-magnetic waves of the ether, radiated from the innumerable suns of the system. But space we know is cold, and when the ether waves from the sun have passed through the icy cold millions of miles of intervening space, they impinge upon the earth, start the air and water and solids of the earth into kinetic vibration, and we have true heat.

In many ways radio waves are transmitted with the same velocity as light waves and the waves which constitute heat radiation. The three are the same kind of waves, differing in frequency.

AMAZING STORIES IN THIS ISSUE: NOVEMBER, 1926

"THE FIRST MEN IN THE MOON," by H. G. Wells. This is undoubtedly one of the greatest moon stories ever written. It is safe to say that only a Wells could imagine such amazing creatures and describe them so vividly.

"THE MAN HIGHER UP," by Edwin Balmer and William B. MacHarg. An engrossing story of experimental psychology, involving the reading of the mind by means of a detecting apparatus.

"THE LORD OF THE WINDS," by Augusto Bissiri. A great scientist has a project for controlling the climate of the hemisphere, but the inventor eventually perishes when approaching his triumph.

"THE EDUCATED HARPOON," by Charles S. Wolfe. This is a wonderful detective story.

"THE SECOND DELUGE," by Professor Garrett P. Serviss. The second installment of this engrossing story.

PRICE 25c PER COPY
AT ALL NEWSSTANDS

Electric waves including radio waves, light waves and radiated heat waves are all referred to by the general term "electro-magnetic" waves. The alternating electric currents used for lighting purposes have a frequency of 60 per second and may produce an electro-magnetic wave of that frequency. Electro-magnetic waves used for radio communication have frequencies of from 10,000 to 3,000,000 per second. Heat waves and electro-magnetic waves have frequencies of from 5,000,000,000,000 to 200,000,000,000,000 per second and the electro-magnetic waves which the eye perceives as light have frequencies from about 400,000,000,000,000 to 1,000,000,000,000,000. The term radiant heat waves is therefore more specific than the term electro-magnetic waves and it refers particularly to those waves having frequencies of from 5,000,000,000,000 to 200,000,000,000,000 per second.

Phosphorescent light and the light given by the firefly and glowworm are practically heatless—EDITOR).

FORBID GUN SALE?—NO!

Editor, SCIENCE AND INVENTION:

Why does not your publication discontinue the advertising of guns and revolvers like some of the other newspapers in New York?

ROBERT NELSON,
New York City.

(The answer to this question may be readily understood. The editors of this publication are of the opinion and belief that each person in these United States is entitled to bear arms for protection. Up to the present time there is no governmental law forbidding the sale or manufacture of fire-arms and we trust that such a law will never be passed. One of the New York daily newspapers, The Daily News, is advocating the abolishment of the sale of pistols. They repeatedly publish a small picture of an automatic revolver captioned "stop selling these," yet their daily barometer which shows the number of deaths occurring in the metropolitan area proves that more than four times as many deaths are caused by automobiles as are caused by the gun. In their totals of deaths by fire-arms they include deaths occurring in the line of duty, as for instance, those resulting from an officer shooting a gangster. These ultimately must be called justifiable. Death occuring by the motor car are not excusable, none of them, yet more than four times as many deaths as from fire-arms occur in this small area of the country. Why shouldn't this newspaper then be consistent and advocate the removal of the greater cause of death—the automobile. The reason for this is that the motor car is a necessary adjunct to our modern business, entertainment and amusement.

When a hold-up man goes out to ply his nefarious trade, he knows that he is already breaking the law by even plotting the hold-up. His success depends in his not being caught. It will make no difference to him whether the sale of pistols or fire-arms is restricted or not. If the man is a law breaker, he will see to it that he obtains his pistols from foreign countries the same as opium is now being obtained by habitués or as alcoholic drinks are also being secured. It makes no difference to the would-be hold-up man whether he is breaking one law or two laws. In either case if he is caught he will be imprisoned. On his use of the pistol depends his ability to get away. At the same time the citizen who is interested in upholding the law is deprived by the laws in certain states of the means of protecting himself, his home and his belongings.

The editor of this publication believes that the country's welfare depends largely on its preparedness and that the welfare of its citizens would be greatly increased by their ability to protect themselves against law-breaking invaders. The balance of justice is always in favor of the victim in a hold-up attack, but it does him little good when he is silenced by a gangster's bullet. We believe that every citizen should know how to shoot. Then he can hold his own against any gangster.—EDITOR.)

INCREASE PRICES?

Editor, SCIENCE AND INVENTION:

I am writing to give SCIENCE AND INVENTION a bit of praise that I think it deserves, although I was extremely disappointed when you discontinued THE EXPERIMENTER.

THE EXPERIMENTER was the only magazine that I have so far really enjoyed and still prized them after I had finished reading everything in them. I cannot see why it did not have readers galore, but all of your publications are A-1 (unbeatable).

The suggestion I am going to make might not meet with approval, but still I am going to make it. Why not increase the size of SCIENCE AND INVENTION and also the price? I like it so well that I would pay twice the present price for 20 to 25 pages more of real good stuff. Really I think the present magazine is too small to keep one busy for very long. I also would like to hear some of the other readers' opinions upon the above suggestion.

RICHARD SIMPSON,
Indio, Calif.

(The suggestion for an increase in price of SCIENCE AND INVENTION *Magazine has been made to us many times and while there are a great many readers who would gladly pay twice the price for this publication, there are just as many who find it difficult to even pay the present price for the magazine that they like so much. Were it possible to decrease the price of the publication the editors would be only too glad to do so. After all it is circulation that counts and the greater the circulation, the more material the reader gets and the lower is the price of the magazine because then the advertising will easily pay for the increased size of the issue.*—EDITOR.)

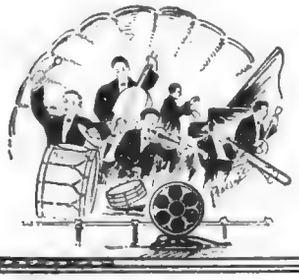
ELECTRICAL INSTALLATIONS

Editor, SCIENCE AND INVENTION:

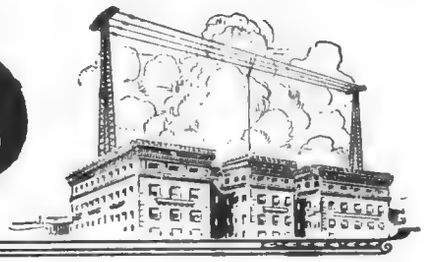
I am a constant reader of SCIENCE AND INVENTION, and I have found it a great aid to me, when I was president of J. H. S. 139 Science Club (Sadalita Scientia) last year. Reading your splendid scientific literature, I take great pleasure in informing you that your magazine is the only magazine that devotes space to moving picture exposures. But I wish to offer a suggestion which I believe is quite plausible. There are a great number of fires occurring, due to faulty electrical installation. Suppose you were to devote some space to the exposition of faulty installation? I think this would help greatly.

ALFRED J. DAVID,
New York, N. Y.

(With the modern method of testing insulation and of inspecting electrical installations there are few fires which are directly due to faulty constructions. Any list of fires and their causes will prove this point. Even if SCIENCE AND INVENTION *did illustrate how faulty installations could be prevented, it would not necessarily follow that wiring and appliances would be installed in accordance with the articles' outline. The National Underwriter's Electric code gives in detail the approved methods of installation of all appurtenances. If its conditions are departed from you cannot insure your house.*—EDITOR.)



RADIO



FLEMING ANNOUNCES RETIREMENT

Dr. John Ambrose Fleming, for many years professor of electrical engineering in the University of London, announced his retirement on August 1, at the age of 77 years. Dr. Fleming is the inventor of the thermionic valve, or vacuum tube, which revolutionized wireless telegraphy and made wireless telephony possible. This photo shows the famous inventor, with one of his many highly developed radio receivers, at his home in London.

SHORTHAND RADIO PHOTO DEVICE

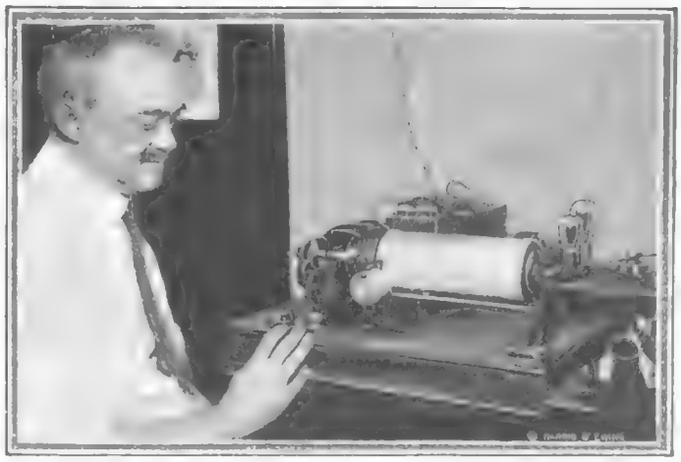
Capt. Ranger, well known electrical engineer, and his assistant, E. H. Hansen, have recently announced the development of a telephoto device with which they expect to completely outclass all present devices. It uses a sort of electrical shorthand to attain unusual speeds of transmission.

THE LATEST IN TRAFFIC REGULATORS

This London constable is standing in the doorway of one of the newly installed traffic autos of the English Police Department. These cars contain radio equipment capable of broadcasting 50 miles and consistently receiving to a radius of 105 miles. This equipment was used extensively during the recent national strike, and also proved its worth in helping to regulate the traffic at Epsom Downs during the Derby, where tremendous crowds were concentrated.

The latest development in the use of radio transmission of photographs is the broadcasting of weather-maps with the assistance of a machine developed in the laboratories of the Washington inventor, C. Francis Jenkins. The weather map is placed on the outside of a glass cylinder inside which a powerful light is housed. Rays from the light pass through the map and are picked up by a photo-electric cell on the outside of the cylinder. As the cylinder rotates, the outgoing radio current is modulated.

WEATHER-MAPS NOW BROADCAST

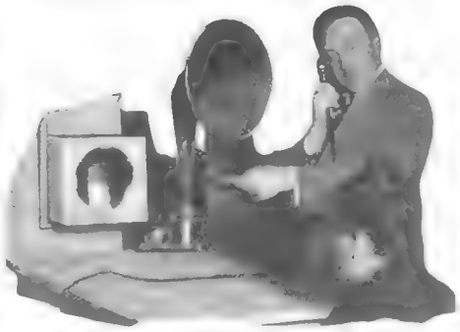


The United States Weather Bureau is contemplating a daily weather-map service by radio to ships at sea, as the result of a series of tests by C. Francis Jenkins, one of the foremost experimental engineers. The equipment for the transmission of complete radio maps has been installed at NAA, the Arlington Naval Radio.

TALKING WITH THE EARTH

On the Berlin Koenigsburg air line in Central Germany, the airplanes have been equipped with telephones which permit passengers to talk with subscribers on the ground. A radio transmitter is carried by the plane, and connections are made at central exchanges with ground telephone lines. Two-way communication is made possible through the utilization of automatic break-in circuits which require no attention on the part of the user.

MORE ABOUT TELEVISION



As a result of the researches of a well-known experimenter and scientist of Edinburgh, "Television, Ltd." has developed the apparatus shown above for the reception of its television broadcasts from one of the largest London stations.

What Music Means

By CHARLES D. ISAACSON, Program Director, WRNY

A Hawaiian Number at WRNY
The spirit of the interesting island is reproduced in Betty Marvyn's music.

Jean Lowell
Who is often heard at WRNY, appeared last year in "Port of London" and will star on Broadway this season.

John Barnes Wells
Favorite tenor of radio land, whose solos were an enjoyable Edison Hour feature of late at WRNY.

Georgette Nyrielle
Soprano, and French leader at WRNY, who presented the big aviation cake to Capt. René Fonck.

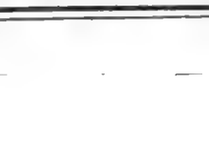
Renee Schieber
Soprano soloist at New York City's famous synagogue, Temple Emanu-El, and a regular at WRNY.

Ragani Devi
Who with her tambura and sitar has brought the Orient from the Vale of Cashmere to WRNY for an Eastern Night's wizardry.

Alfred Hall
Introducing in person WRNY's affable announcer, with whom you already feel an established acquaintance.

Yugi Hirose
He broadcast Japanese melodies from WRNY. His father was the first native Christian minister in Japan.

Vincent Ballaster
Baritone, and headliner of the Metropolitan and Chicago Operas, has been an Edison Hour soloist lately at WRNY.



RADIO broadcasting consists of music to so great a degree that it may not be amiss if I try to give you a little of the beautiful vision I have of the immortal and angelic art.

Of course, radio has changed the opinions of millions about music—by just bringing it into homes where it was formerly unknown. People who wouldn't take the trouble to go to a concert or opera, took a little taste, by accident, or in an adventurous spirit—and found that it wasn't so bad!

That clever gentleman, George Jean Nathan, in his "House of Satan," says that radio has helped to drag down American taste, by distributing poor music. As a matter of fact, Mr. Nathan, if he had really made any careful observations at all, would have found that more people have had an introduction to good and broadening things through the radio, than have ever been hurt by it. I have yet to meet an individual who ever went with pleasure from fine uplifting drama or excellent music to the "cheap" things.

The history of the world is that of its gradual moving upwards toward better standards. Radio has, it is true, broadcast much of jazz and ragtime and stupid, banal, worthless music. But it has also sent into countless homes so much that is of the better type.

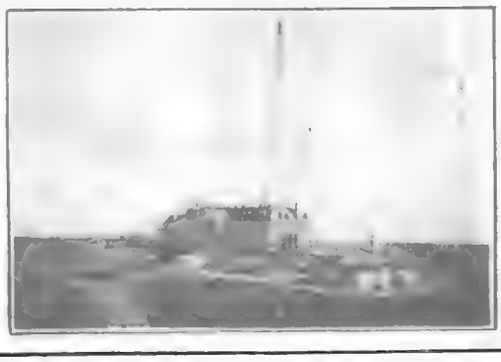
You have all heard about the gentleman who when asked about the opera, said that it was a place to sleep in, and that they charged you so much, but you couldn't sleep anyway because they made so much noise. Art has been looked upon as "highbrow," and good things called uninteresting.

I never want a human being to desire good things only because it's "the thing to do"—there's too much faddishness and affectation in life as it is. True, many make a society function of music; but the people who have stood for hours in sleet, snow and rain, to get standing-room at the opera house, know why they need something which only beauty can bring into their lives.

I always insist that if you can't get as much of a kick out of opera concerts or art exhibits as you do out of a movie or a baseball game, you had better stay home! But you can get more; more of something else. What is that something else? It is something, which is hard to tell about, hard

(*Continued on page* 647)

Station WMAF, Dartmouth, Mass.
Col. E. H. R. Green's big station, which rebroadcasts WRNY programs each Tuesday and Thursday.



Dr. Bernard Katzenstein
Is WRNY's dental authority. He broadcasts hygienic advice on the care of your mouth.

Virginia Morone
Comes from Georgia, which, as you already know, is famous for raising peaches. One of WRNY's finest sopranos.

David Putterman
Not only the youngest cantor of American birth, but one of the finest. He is often heard over WRNY.

Hon. F. H. LaGuardia
New York's eloquent and aggressive congressman, is a regular WRNY speaker, and well worth hearing.

Neville Brush
Is often heard in dramatic readings at WRNY. Here he is gazing upon the famous Raven in his thoughts.

Josefa Chekova
Who brings the spirit of old Bohemia (not the Greenwich Village kind) to WRNY in her songs.

Maya De Cortez
She has been a star in Italy and America. She is now a star at WRNY and figures frequently on its program.

Increasing Selectivity

By A. P. PECK, Assoc., I. R. E.

DID you ever spend hours of time working on a radio receiving set, using the very best of parts and following a standard circuit that is known for its efficiency, and then, after everything is hooked up and the set is tried out, find, very much to your surprise, that the set is broad in tuning? If you have done this you have only followed in the footsteps of hundreds of other radio constructors. It is no unusual thing to have this happen, and it is surprising to note the ignorance that is so prevalent regarding the elimination of such trouble. If the circuit used in your set is fundamentally of a good type and it is so designed as to be fairly selective, there is no reason why you should not get the very best results from it. If you find it is non-selective, do not blame the circuit but blame yourself. More often than not there is some fault in the construction or method of putting the parts together that has made the receiver non-selective. In view of the lack of information on this subject, and of the fact that few if any articles have attempted to put forth in a concise and complete form the remedies for broad tuning, we will attempt to cover the majority of such remedies here.

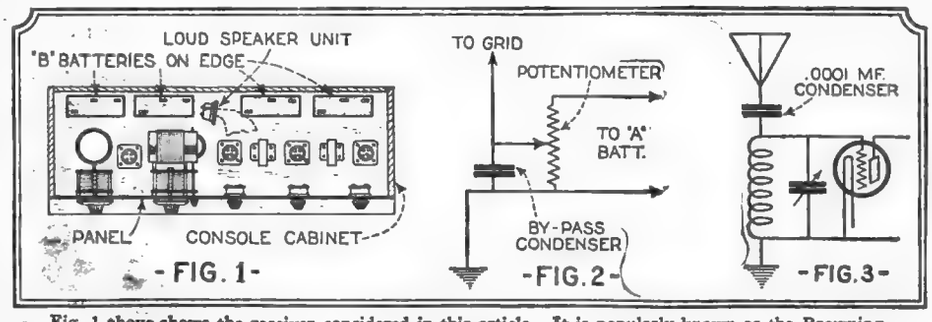


Fig. 1 above shows the receiver considered in this article. It is popularly known as the Browning-Drake. Figs. 2 and 3 show two uses for condeners, a by-pass across the potentiometer and in series with the antenna lead. It is essential that only the best makes be used.

One of the fundamental causes of non-selectivity or broadness of tuning is resistance in the circuit. If any part of any one of the tuning circuits in a radio receiving set has a comparatively high resistance, that circuit is going to be broad in tuning. With a set of the usual tuned radio frequency type, an undesired resistance in one stage is not so bad because if the other two stages are functioning properly they will act as sufficient filter to enable you to separate stations quite satisfactorily. However, nobody wants to have a set that is not operating at its greatest efficiency, and, therefore, if you are using a tuned radio frequency receiver of the conventional 5-tube type and find that one of the controls does not tune sharply enough, read on. You will probably find something here that will aid you in overcoming the trouble.

Not only are the tuned radio frequency receivers subject to broad tuning, but also any other type of set will not tune sharply if its tuning circuit or circuits have too high a resistance. With the receivers that are quite popular today and which incorporate one stage of tuned radio frequency amplification and regeneration in the detector circuit, we have only two controls, and if one of them is non-selective, the over-all results obtained will not be at all satisfactory. When such a condition is found the trouble hunt starts.

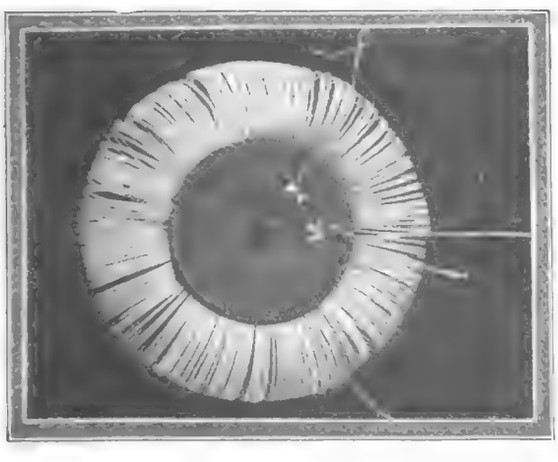
It was not so long ago that the writer was called into the home of a radio fan to diagnose trouble in just such a receiver. The set itself was a beautifully finished job. It was of the well known Browning-Drake type and was built, using parts that were standard and manufactured according to rigid specifications. The set was encased in a handsome mahogany console cabinet and certainly looked as if it ought to deliver all kinds of results. However, such was hardly the case. Turning the set on, it was found that a near-by high powered station could be heard practically regardless of the setting of the antenna dial. The second or detector tuning dial was fairly selective but still was not up to standard. The first thing to do of course, was to check the wiring and joints. A poorly soldered joint will introduce so much resistance into a circuit that the tuning will be broadened considerably. If joints are "soldered" with flux you will notice very broad tuning. However, in this particular case no such trouble was located. Each joint was perfect. Each connection to the rotating plates of the variable condenser was in first-class shape and needed no attention whatsoever. The spaces between the condenser plates were clean. The windings on the coils were, as mentioned before, factory made, and the turns were spaced so as to still further reduce the radio frequency resistance of the circuit. And there for a few minutes we were stuck. The set itself was just about as perfect a job as could be imagined and still did not deliver the goods. And so we sat down and studied the set very carefully. Eliminating every part of the set itself brought us to the conclusion that some outside influence must be exerting itself upon the receiver and affecting the results.

Time grew short, and so we removed the set from the cabinet, after taking off all the external connections, and transported the receiver to our laboratory. There it was hooked up to an antenna and ground and a set of batteries, and much to our amazement, it worked perfectly. The qualities of tuning that should be exhibited by such a set were present in all their glory. Not a thing wrong with it. The next night, back the set went to its owner and there was studied still further. The antenna was of conventional length, being only about seventy-five feet long from the binding post of the set to the extreme end. This is a point that you want to watch in connection with selectivity. An antenna that is much longer than that just mentioned will decrease selectivity and will give you poor results, especially in a crowded location. Once more the set was in its console cabinet and it returned to its original state of non-selectivity.

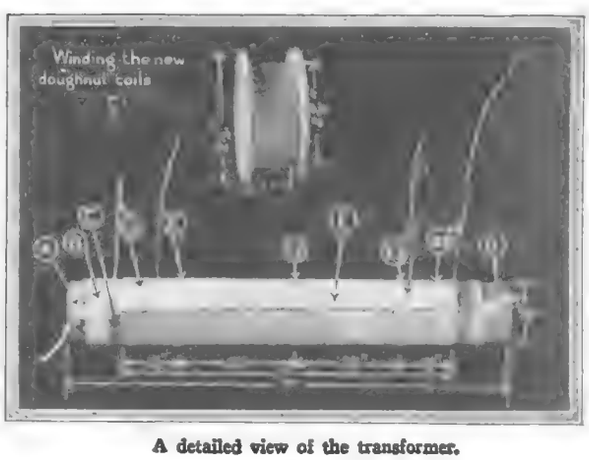
The owner, in an attempt to conserve space within the console, had lined up his "B" batteries very close to the set. The "B" batteries were of the metal case type and one of them was located within about an inch of the antenna tuning coil. Another of them was located within ¾" of the detector tuning coil. Now it is a more or less known fact that any unnecessary metal placed in the field of a coil carrying radio frequency current will tend to increase the resistance in the circuit of that coil, and therefore render tuning broad. Removal of the "B" batteries to a more distant point immediately assisted greatly, but still the results were not of the best. However, the "B" batteries were placed in one side compartment of the console so that they would be

(*Continued on page* 651)

Home-Made Toroidal Coils



At the left you will see a very neat and efficient type of toroidal radio-frequency transformer which may be easily constructed at home by the radio fan. The coil is first wound on a broomstick covered with wrapping paper, and is then transferred to a mounting core of the dimensions given at right. In the photo at right, G is a broomstick or cardboard tube so arranged that the coil may be removed after winding, B is the secondary winding. C is the paper separator, D, D2, E, E2, E3, are primary taps, F is a strip of adhesive binding tape.



A detailed view of the transformer.

The Home Set

By A. P. PECK, Assoc. I. R. E.

Fig. 5. Two discarded articles of household furniture were used in the preparation of this set. The upper two drawers of an ancient highboy were removed to admit the set, and a phonograph was used as a loud talker.

MY wife wanted a radio set. In fact she not only wanted one, but she demanded it. It had to be a set that could be put into operation when it was finished, and keep on working consistently. It also had to be one that was easy to tune and must be up to date. After it was finished I must keep my hands off it. It was not to be torn apart or played around with every time a radio magazine came out with a new circuit. In all the years that I have been making radio receiving sets and experimenting with radios in general, I must frankly admit that I had never had a radio receiving set working for more than two weeks at a time, nor has my wife ever had the pleasure of having one of her own. Therefore I decided to concede to her demands.

Of late I have been doing quite a little work with "B" battery eliminators, and, therefore, of course, the first thing I decided upon was that the new set should have a real, honest-to-goodness "B" eliminator that would give actual results and would not cause the loud-speaker to give an imitation of an airplane engine in operation. Also I have recently become infatuated with a particular type of receiving tuner employing one stage of tuned radio-frequency amplification and regeneration in the detector circuit. I am pretty well tired of floppy tickler coils and other inconsistent methods of accomplishing and controlling regeneration, and, therefore, in this new set it was decided upon to control regeneration by means of an ordinary variable condenser.

The setting for the receiver next had to be selected, and here the reader will do well to take heed. Undoubtedly somewhere around the house, or possibly tucked away in some forgotten corner of the attic or storeroom, there is some sort of chest of drawers or similar old-fashioned piece of furniture that can be converted into the finest imaginable housing for an up-to-date receiving set. The cabinet I resurrected was originally used for holding cylindrical records used in one of the original models of "gramaphones." It proved to be ideal for the purpose. As can be seen in the photograph, Fig. 5, I removed the two top drawers of the cabinet, took out the wooden strips which were designed to support the upper drawer, and there was a first class cabinet. Taking the measurement of the space so formed, I had a panel cut to fit, and next went to a near-by carpenter and had a baseboard built. This was also cut to fit, and after the set was finished it could be slid into place just as though it were one of the drawers belonging to the cabinet. All of the wires connecting the set to the aerial, ground, "A" battery and 110-volt A.C. lighting circuit were arranged to enter the cabinet through holes in the back. In my particular location the radio set proper was located on the second floor, and the "A" battery directly above it on the third floor. This kept the "A" battery out of the way and out of sight. The connecting wires were "fished" through the wall and brought out through a small hole in the baseboard directly in back of the cabinet. Fig. 5 shows the radio set just as it stands today. Note that there is not one wire visible. The aerial was also brought into the third floor and down through the walls. The ground wire was run to the radiator. The twisted pair leading to a nearby base plug, was concealed in a crevice in the moulding around the baseboard. I give all of these details here because I am sure that a good many of the readers will be able to adopt some of them when installing a radio set which will be a true piece of furniture.

Our old Victrola, now seldom used, was placed upon the top of the cabinet as shown, and a phonograph attachment was used in place of a loud-speaker. The wires connecting this to the set were run out through the back of the Victrola and into the set through the back of the cabinet.

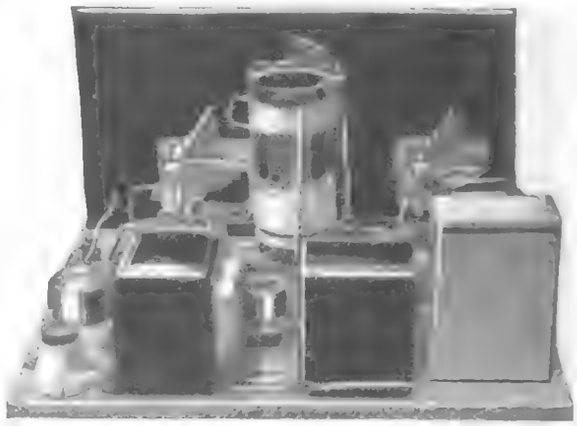


Fig. 1. The arrangement of the chokes and condensers for the B battery eliminator may be easily seen in the above photograph. The wiring throughout the set is done with spaghetti covered bus bar, bent and cut to size.

THE SET

Reference to photographs, Figs. 1, 2 and 3, will quickly show the reader just how the set was laid out. Although the cabinet used is rather high, still it is not very wide, and therefore, quite a little juggling of instruments was necessary before a satisfactory layout was achieved. Even at that it was found necessary to mount the instruments a few at a time and connect them up before placing others in position. Otherwise it

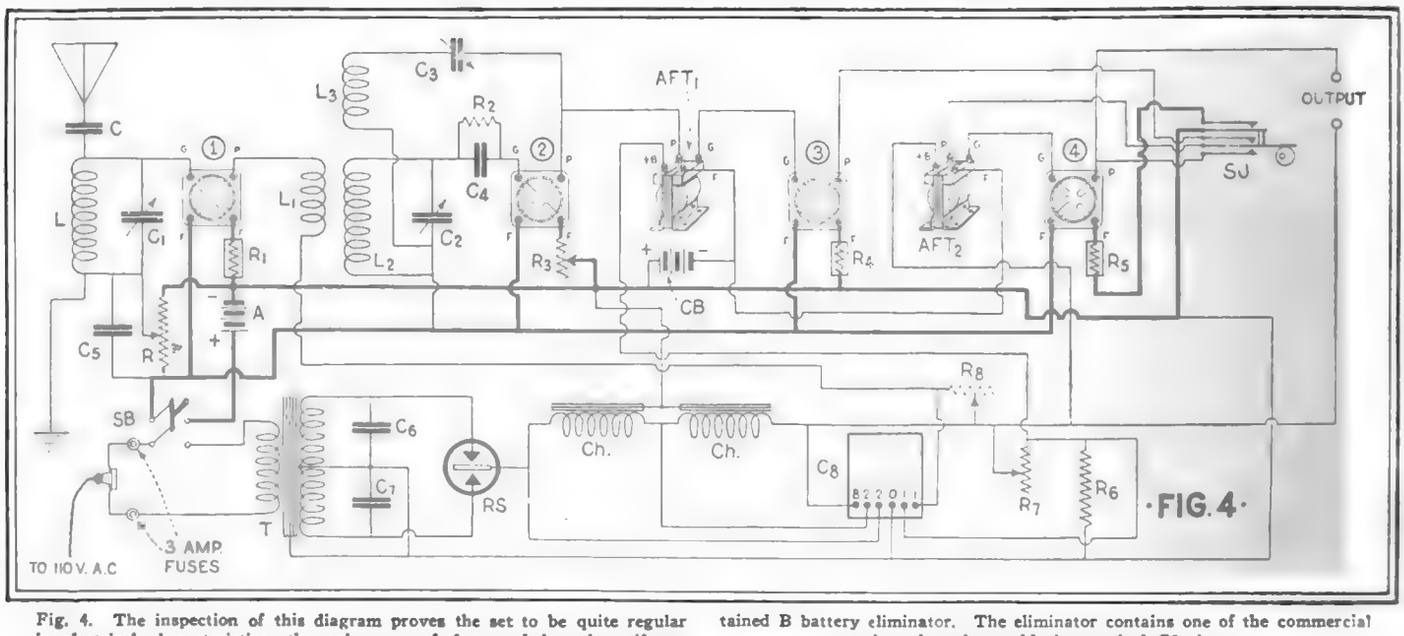


Fig. 4. The inspection of this diagram proves the set to be quite regular in electrical characteristics, the only unusual feature being the self-contained B battery eliminator. The eliminator contains one of the commercial makes of condenser blocks, marked C8 above.

would have been impossible to make connections with any degree of satisfaction.

The coils for this receiver indicated by L, L1, L2 and L3 in the diagram Fig. 4, are all wound on thin-walled bakelite tubing three inches in diameter. Ten inches of this tubing is necessary. It should be obtained in two pieces, one three inches long and the other seven inches long. The antenna coil, L in the diagram, consists of forty-six turns of No. 20 DCC. wire and is mounted parallel with the baseboard. The other three coils are wound on seven-inch tubing which is mounted perpendicular to the baseboard and directly to the rear of the regeneration control condenser. At the lower end of this tube are wound twenty turns of No. 30 DCC. wire. This constitutes the plate coil. About 3/16 of an inch away from this coil and in the opposite direction to it is wound the secondary tuning coil. Here again forty-six turns of No. 20 DCC wire are used. A space of two inches is now left, and then the R.F. plate coil is wound in the same direction as the secondary tuning coil. This consists of twenty-five turns of No. 20 DCC wire. For fastening the ends of the wires I used soldering lugs clamped firmly to the tubing by means of eyelets such as are often employed in legal offices for holding sheets of paper together. The wire was pushed through a hole in the tubing, and then up through the eyelet and was soldered to the lug. In this way an excellent terminal is provided as well as a method of fastening the wire.

The above described coils are designed to be used in connection with two .0005 mf. tuning condensers and one .00025 mf. regeneration condenser. When building this set I did not have a small variable condenser on hand, and therefore, several of the rotary plates were removed from a .0005 mf. straight line capacity condenser. The tuning condensers should preferably be of the straight line frequency type in order to facilitate tuning on the short waves.

Anyone deciding to build a set of this nature even though they are not going to use exactly the same layout as is shown here, should follow carefully the directions given above for the construction of the coils. It is quite essential that these be made correctly. It would seem off-hand that the very loose coupling between the R.F. plate coil L1 and the detector grid coil L2 would tend to reduce the volume of received signals to an undesirable degree. This, however, is not found to be the case in actual practice, but the effect of the loose coupling is to increase the selectivity tremendously. I am using this receiver (or rather my wife is most of the time) in a location that is noted for interference from the super-power station, WJZ. However, there is never any trouble in tuning out this station and tuning in others operating on nearby wave-lengths. You will be able to obtain the same degree of selectivity if you take care to use loose coupling. Do not try to use greater coupling than two inches, but, on the other hand, unless you are in an isolated neighborhood far from broadcasting stations, do not make this coupling any closer than one and one-half inches.

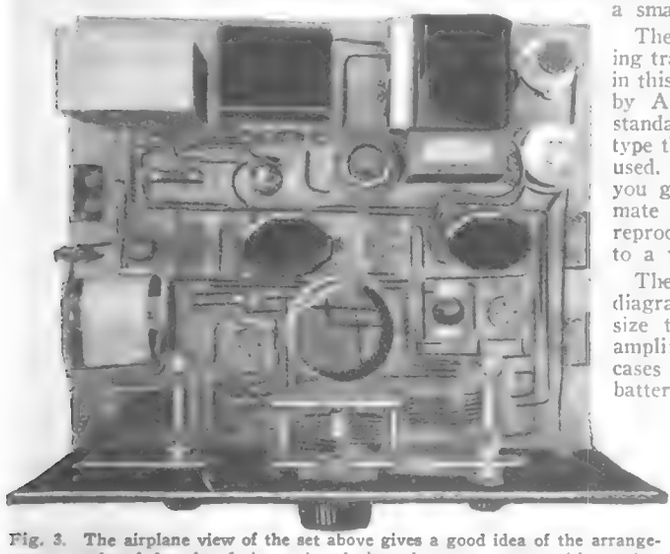


Fig. 3. The airplane view of the set above gives a good idea of the arrangement employed by the designer in placing the components with a view toward high efficiency, with conservation of space.

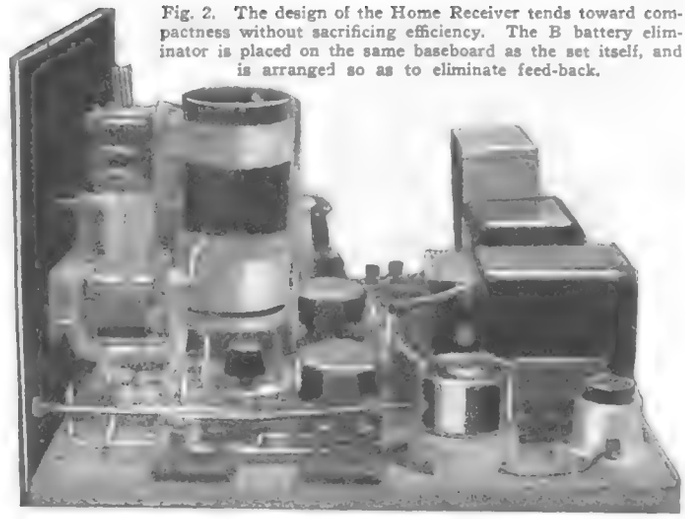


Fig. 2. The design of the Home Receiver tends toward compactness without sacrificing efficiency. The B battery eliminator is placed on the same baseboard as the set itself, and is arranged so as to eliminate feed-back.

It may seem strange at this late date to see a potentiometer included in a radio receiving set. If, however, it is by-passed by means of a fixed condenser having a capacity of 1 mf., the objections to the potentiometer are overcome. Furthermore, the use of a carbon disk instrument such as the Bradleyometer has many advantages over the older wire wound type. In this circuit, Fig. 4, the potentiometer or Bradleyometer is indicated by R, and the by-pass condenser by C5. The main reason that I used a potentiometer was so that practically any type of tube could be used for the R.F. amplifier (1). It is surprising to note what good results can be obtained with radio-frequency amplification when properly controlled, and the potentiometer and by-pass scheme does the trick.

Another thing that is quite essential in this set is a good grid leak. Use a variable type that is consistent in operation and you will have no trouble at all. This instrument is indicated by R2, and the usual fixed grid condenser of .00025 mf. capacity is indicated by C4.

In order to remove all wires from the front of the radio receiving set, it was necessary to eliminate the use of a jack. Still it is not always desirable to use both stages of audio-frequency amplification. Therefore, the switch of the jack type indicated by SJ in the diagram was incorporated in the set. In one position this switch throws the output into the plate circuit of the last amplifier tube (4), and in the other position the filament of the tube (4) is extended, and the output is thrown into the plate circuit of the first audio-frequency amplifying tube (3). All of this controlling is done by means of a small button on the panel.

The audio-frequency amplifying transformers that were used in this set and that are indicated by AFT1 and AFT2, are of standard manufacture and any type that may be at hand can be used. However, be sure that you get good ones, as the ultimate success and clearness of reproduction depends upon them to a very great degree.

The "C" battery, CB in the diagram, must be of sufficient size to properly bias the two amplifying tubes. In some cases an ordinary 4½-volt "C" battery will be of sufficient size, whereas at other times voltage up to 9 will be required. Only experience can determine this.

THE "B" ELIMINATOR

While there are several types of "B" eliminators in practical use today, I picked upon that type using the Raytheon tube. In my personal opinion, it is the best type of tube for the average person to employ for "B" battery elimination, and should have a far greater life than any other tube equipped with a filament. Used with this Raytheon tube is a standard "B" eliminator transformer whose secondary is shunted by two fixed condensers of 1 mf. capacity, indicated by C6 and C7. Then there are, of course, two choke coils; encased in a single housing in the particular type that I selected. It is necessary to have filter condensers in this "B" eliminator circuit, and in order to simplify wiring, a condenser block was selected. This is indicated by C8 in the diagram. It is far more satisfactory for the average constructor to purchase a block of this nature than to attempt to use a number of single units. By using the block much wiring is done away with.

In order to properly control the output of the "B" eliminator, three resistances are necessary. One is a fixed resistor of 7,500 ohms. This is indicated by R6. Then, two variable resistors are used for controlling the voltage supply to the detector and the radio-frequency amplifying tube. The detector resistor is indicated by R7, and has a resistance of from 5,000 to 50,000 ohms. The R.F. control resistor is indicated by R8, and has a resistance of from 1,000 to 10,000 ohms. After setting up the receiver, these two resistances should be adjusted for best results with your particular tubes.

Now comes a stunt that I think is quite novel. This is the switch used for controlling the set. At any electrician's store you can purchase a double pole single throw pull chain switch of the wall type. This, in my set, was mounted on the base board, and the cord controlling it was led out through the panel. A small tassel fastened to the cord lends a decorative touch. By properly hooking up this switch as shown in Fig. 4, a pull of the cord turns the set on or off. A small panel light was included in the circuit in order to serve as a pilot so as to show when the set was on or off.

In order to facilitate tuning, vernier dials were used on the two tuning controls, but an ordinary knob and pointer was placed on the regeneration control condenser. This latter is not critical, and therefore an unusual touch is added to the panel by this arrangement. Before the panel was drilled, a scale was engraved on the panel in order to indicate the relative position of the rotary plates of the variable condenser. This scale need not be numbered.

TROUBLES

It is possible that you may have some trouble with a receiving set of this nature. I will outline the most usual stumbling blocks.

(*Continued on page* 650)

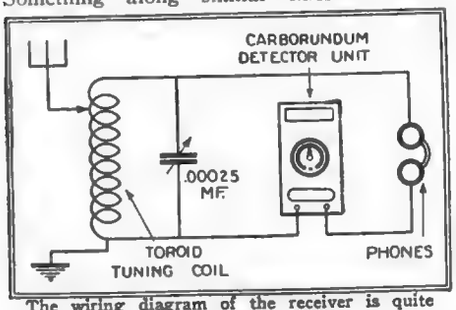
Novel Dial Set

By HERBERT E. HAYDEN

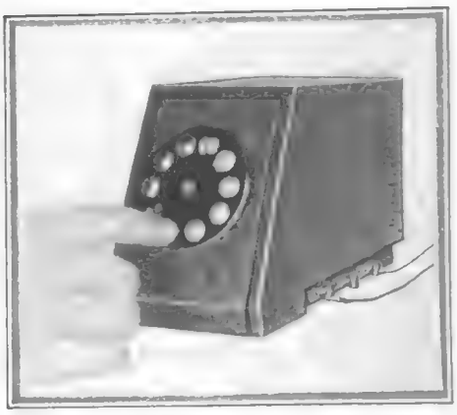
A side view of the novel crystal set, showing location of the various parts.

MOST of us are now quite familiar with the dial telephones which enable subscribers to obtain the desired connections without the services of an operator. Something along similar lines has been worked out in connection with a radio set. Of course, the operator is required in this case, but the method of tuning as well as the appearance of the set are nevertheless quite novel.

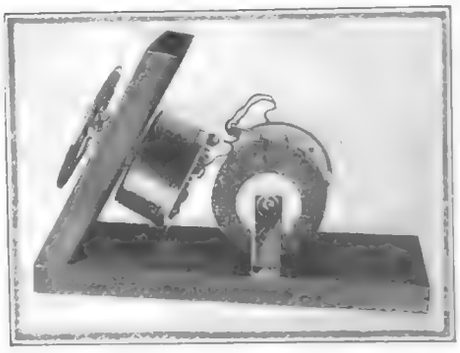
The construction of the set is simplicity itself. The parts required and a toroidal coil, a .00025-mf. condenser and a carborundum detector unit. The dial used for tuning is cut out of a bakelite panel by means of a fret saw. Preparatory to cutting out the disk, two concentric circles should be described, the outer one being the periphery of the disk and the inner one the center line for the series of holes which are to be drilled. The centers for these holes are laid out along the inner circle and spaced at equal distances apart. If 12 holes are to be drilled, as in the set shown in the photographs, they may be spaced accurately by taking half the radius of the circle and laying the distances out along the inner circle with a pair of dividers. A hole is drilled in the center of the disk of the proper size to admit the bushing which fits over the condenser shaft. A white paste board or paper dial slightly smaller in diameter than the perforated tuning dial is mounted directly behind the latter on the panel. A scratch mark is made over one of the holes in the tuning dial and filled in with white lead. This marked hole is for reference purposes. The set is tuned until a station is heard. The call letters are then filled in on the paper dial directly under the marked hole on the tuning dial. For compactness, simplicity of construction, ease of adjustment and novelty of design this little set is hard to surpass, and will more than repay the builder for the small amount of time required to construct it.



The wiring diagram of the receiver is quite simple, the set consisting only of a toroidal tuning coil, a compact type condenser of .00025 mf., and a carborundum detector unit.



The above photo shows how the set is tuned by inserting the forefinger in one of the holes in the dial.



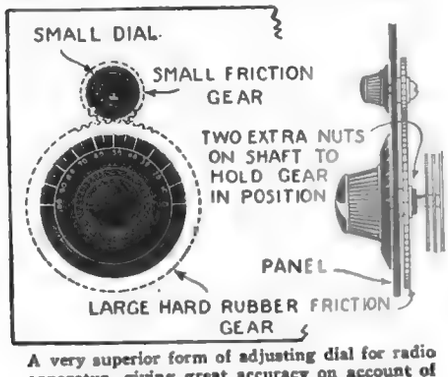
The detector unit is removed in this view, which shows only the coil and condenser.

A Micro-Adjustable Dial

A LARGE disc of hard rubber, around the edge of which has been fastened with rubber cement, a narrow strip of rubber cut from an old inner tube, is placed on the dial shaft behind the panel. This disc or gear is held firm on the shaft by means of nuts one on each side, tightened, flush against it. A washer should be placed between the panel and the nut next to it. When the outer dial is turned, the large disc behind the panel will turn with it.

Above the regular dial, drill a hole for the shaft of another smaller dial. A small disc or gear, having the rubber fastened to it as in the larger disc or gear is placed on this shaft so that the rubber tires of the two gears will grip or engage one with the other. When one dial is turned, the other will turn also, due to the friction gears formed by the India rubber edges. The degree of accuracy with which tuning can be accomplished will depend to a large extent upon the ratio between the small gear and the large one.

For rough adjustments, use the large dial. For very fine adjustments, use the smaller dial. *Contributed by* CLYDE E. VOLKERS.

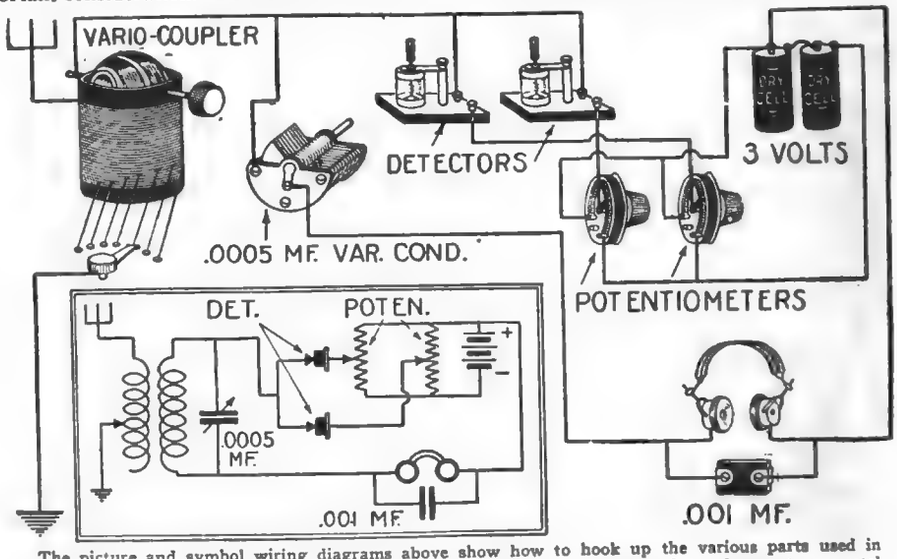


A very superior form of adjusting dial for radio apparatus, giving great accuracy on account of the reducing gear employed.

Unique Crystal Hook-up

IN spite of the almost universal use of the vacuum tube as a detector and amplifier the crystal nevertheless can still hold its own when clarity of reproduction is an important consideration. For it is a well known fact that the crystal detector delivers a practically undistorted replica, in rectified form, of the radio frequency current impressed upon it. The vacuum tube does not do this as perfectly as the crystal detector. A little experimentation with crystal circuits might therefore prove profitable.

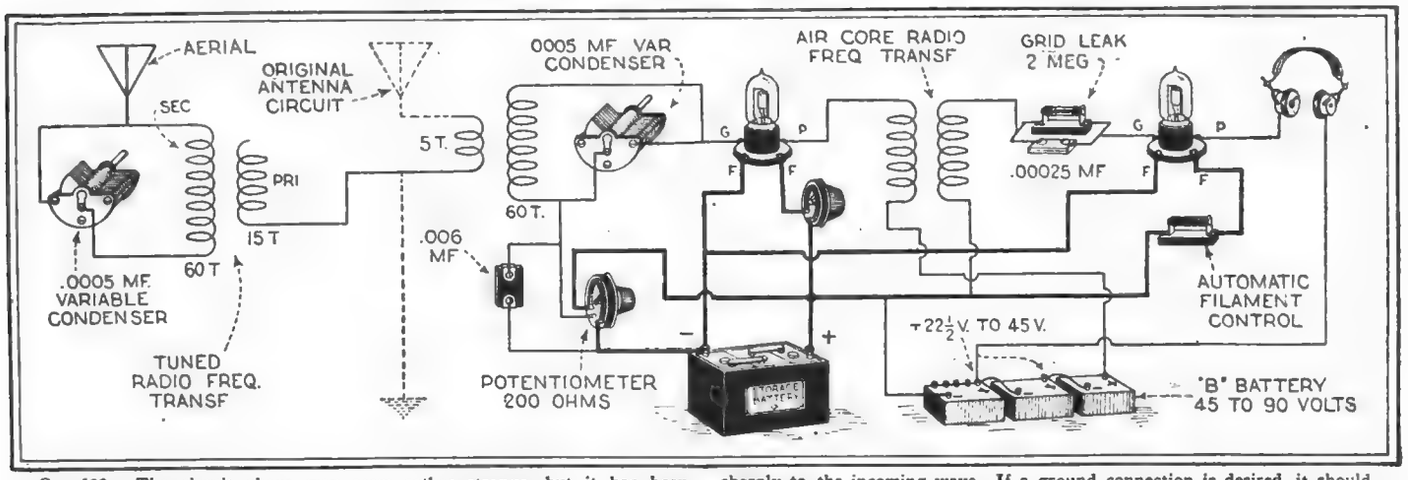
We have shown here a hook-up employing two crystal detectors. Each detector has connected to it a potentiometer, and both potentiometers are connected to a common 3-volt battery consisting of two dry cells. The use of the potentiometers greatly increases the sensitivity of the crystals by applying to the latter the voltage necessary to obtain the best operating conditions. Operation of the set is improved to a large extent by the utilization of two crystal detectors in place of the customary single detector. This arrangement gives more complete rectification of the received signals. For best results the potentiometers should be adjusted individually.



The picture and symbol wiring diagrams above show how to hook up the various parts used in this circuit. An ordinary variocoupler with a tapped primary, a .0005 mf. condenser, two crystal detectors, two potentiometers, two dry cells, a .001 mf. condenser and a pair of phones constitute the essential parts.

RADIO ORACLE

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.



Q. 509. The circuit above may seem rather strange, but it has been tested and found to be very selective. Both oscillating circuits are tuned sharply to the incoming wave. If a ground connection is desired, it should be made to the filament negative.

ADDING SUPER-SELECTIVITY

(509) Q. 1. Mr. Weston Bruner, Raleigh, N. C., asks how he can improve the selectivity of his present receiver.

A. 1. The diagram above shows a circuit employed by the Radio Editor of SCIENCE AND INVENTION Magazine to achieve the results acquired. This is an adaptation of the "N" circuit originated by Sir Oliver Lodge. Note that no ground connection is used, as the batteries act as a sort of counterpoise antenna.

AUDIBILITY STANDARDS

(510) Q. 1. Miss Daisy Cooper, Oxford, N. C., inquires if there is a definite standard for audibility and quality of signals recognized by the radio fraternity.

A. 1. Here is the table usually enployed:

Signal Audibilities

R1—Faint signals, just audible.
R2—Weak signals, barely readable.
R3—Weak signals, but readable.
R4—Fair signals, easily readable.
R5—Moderately strong signals.
R6—Strong signals.
R7—Good, strong head-phone signals. Would be readable through heavy QRN and QRM.
R8—Very strong signals. Medium loud-speaker volume.
R9—Extremely strong signals, strong loud-speaker volume.

Phone Audibility and Quality

M1—Speech garbled.
M2—"Hashed" speech.
M3—Uneven modulation.
M4—Clear voice.
M5—Very clear, modulation perfect.

Q. 2. We are asked to print the recently developed Donle circuit.

A. 2. The diagram below is the adaptation of the Donle circuit employed by the manufacturers of a well known "Catacomb" amplifier. We are unable to furnish the complete constants for the impedance units, but we presume that they are designed to match the impedance of the tubes to be used. Hi-mu tubes may be used to advantage in all circuits using either impedance or resistance coupling for audio-frequency amplification.

"A" AND "B" BATTERIES

(511) Q. 1. Mr. H. Richard Miller, Lititz, Pa., asks: Why it is that radio sets require two different kinds of batteries, and why it is that they are called "A" and "B" batteries?

A. 1. To explain why we have "A" and "B" batteries in a receiving set, the functions of each, and why one high-voltage and one low-voltage battery is used, it is necessary to go into an explanation of the principle of the vacuum tube as used for radio purposes. We will attempt to make this explanation as clear and non-technical as possible. For a technical and lengthy explanation of the evolution and functions of a vacuum tube, the reader is referred to the December, 1925, January and February, 1926, issues of THE EXPERIMENTER or to Morecroft's "Principles of Radio," or Van Der Bijl's "Thermionic Tubes."

Through the researches of scientists, such as Thomson, Richardson and Millikan, we know that when certain metals are heated to incandescence, quanta of negative electricity are emitted, which particles are called electrons.

In 1904 Fleming (another scientist) was granted a patent on the device called a "Fleming valve," which consists of a filament-and-plate element enclosed in an evacuated glass vessel. The filament was heated to incandescence. In school, in the physics or science class, we learned that positive attracts negative, or vice versa, depending upon which has the greater strength. Fleming inserted in his device a battery of high potential. The positive side of this battery was connected to the plate within the vessel, thus making the plate highly positive, thereby enabling it to attract the electrons which were thrown off by the heated filament. This device was of little practical use as far as radio (in those days called "wireless") was concerned, until 1906 when DeForest inserted the third element called the "grid," thereby making the most sensitive detector known. The current from cold plate to heated filament is due to the Edison effect, discovered by the great inventor.

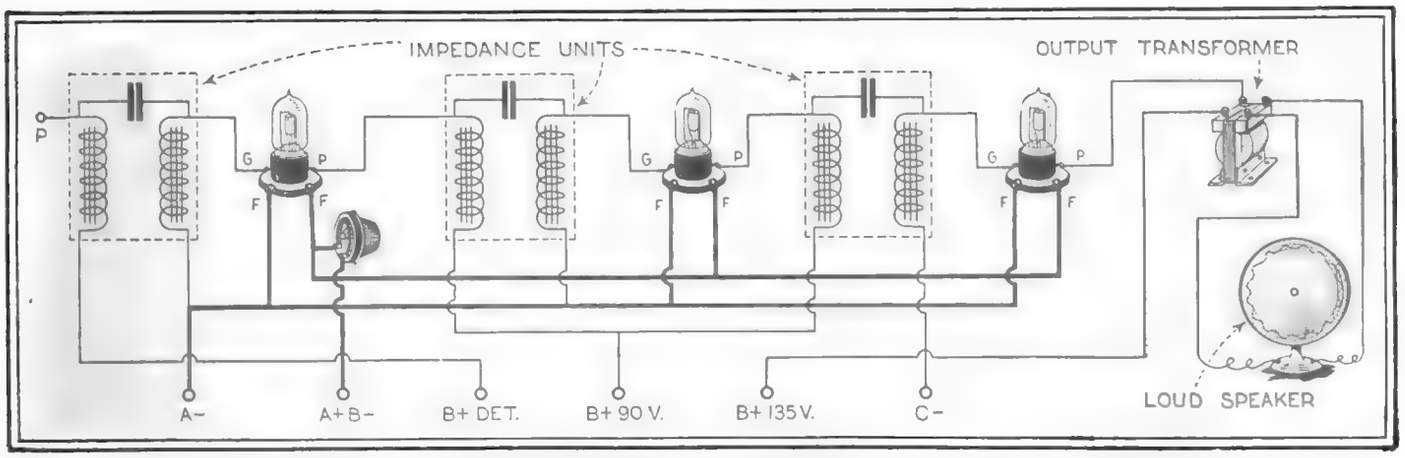
Now to show how "A" and "B" batteries are concerned. The battery required to heat the filament to incandescence is called the "A" battery (probably because it is the first battery to be taken into consideration), or primary battery. The battery required to give the plate its positive potential is called the "B" battery. The filament passes in typical tubes a current of ¼ ampere, a large current compared to the plate current of the tube, (current from plate to filament). The battery necessary to heat the filament must have a relatively high amperage capacity, and ranges from 120 ampere-hours up, its period of life depending upon the number of tubes used in the receiving set and the type of tubes. In the early days tubes were manufactured with filaments which required six volts and consumed about an ampere. At present, due to research and developments made by the General Electric engineers, we have radio tubes which operate from a dry cell or two, and consume only from .06 to .25 of an ampere.

The "plate" current of the tube is very small as we said above, but requires a relatively high potential, varying from 22½ volts for a "soft" or detector tube to 90 volts for the ordinary amplifier tube, and about 135 volts for a power-amplifier. Ordinary "B" batteries are constructed (by assembling a number of very small cells) so that their amperage capacity is very low. Their life ranges from 2 to 7 ampere-hours of total output, the voltage delivered is high because of the small cells, each of which delivers only 1½ volts, which are connected in series.

REPLACING ANTENNA WIRE

(512) Q. 1. Archie Nicholas, South Bend, Indiana asks: "Is it advisable to change my antenna after four months' service on account of corrosion? Will corrosion of the antenna wire tend to weaken the signals?"

A. 1. Unless you are situated close to a chemical plant or a factory which exhausts chemical fumes into the air, we do not believe that your antenna will become very badly corroded after a period of four months. It is advisable, however, to inspect the antenna wire at least once a year and if very much corrosion is in evidence, to install a new length of wire. The insulators should be washed free from the dust and smoke which have collected on the surface.



Q. 516. Several manufacturers have recently introduced amplifiers employing the Donle system of impedance coupling, the circuit diagram of which is given above. The amplification available with this system is nearly equal to transformer coupling, and is almost completely distortionless.

Scientific Humor

POSITIVELY NEGATIVE

My friend (a newcomer to the noble ranks of "B. C. Ls") came to me airing his woes—as usual.

"Say!" he began, "I wrote a mail order house for some goods."

"Yes?"—encouragingly.

"They sent them."

"Well?"

"They wrote that all their sockets had positive contacts."

"What's wrong with that?"—exasperatedly.

"Wrong?" Where the deuce am I to connect with the A minus (negative) lead?"

—*Clifford W. Allwood.*

POSSIBLE

"Tut, tut," scolded the mother, "you shouldn't be afraid of the thunder. It's nothing but a big noise and never hurts anybody."

"Yes it does, mother," persisted the child, "I was reading a story yesterday where it said a man was *thunder-struck.*"—*John H. Spicer.*

WHY, OF COURSE

The old lady was eagerly questioning the parachute jumper about his experiences and sensations while falling through the air.

"But what do you do if your parachute refuses to open while you are falling?" she finally asked.

"Take it back up and fix it," was the laconic answer.—*John H. Spicer.*

CANAL BOATS

MIKE: "See my new shoes?"

IKE: "What are they?"

MIKE: "Footcraft's."

IKE: "I see they are crafts, but of what tonnage?—*Alvah Carson, Reporter No.* 24409.

FORTUNATE YOUTH—HE NEVER HAD ONE

ELECTRICAL INSTRUCTOR: "Students, economy is essential to successful electrical installation. Can anyone suggest an economical practice?"

PROMISING STUDENT: "I have an idea to save wire."

PROFESSOR: "Excellent! How?"

STUDENT: "By making short circuits whenever possible."—*Samuel W. Williams.*

MAC HINERY (MACHINERY) IS AN IRISHMAN

DUMB: "Does he know anything about machinery?"

DUMBER: "Why say, he's so dumb he thinks a lathe bench is a seat in a slat factory.—*Clarence Conc.*

IRONICALLY SPEAKING

CIRCUS FOREMAN: "That iron-jawed chain biter with the side show tried to kill our cook today."

CIRCUS OWNER: "What was the trouble?"

CIRCUS FOREMAN: "He said the pie crust was too tough to eat"—*John H. Spicer.*

First Prize $3.00

THE RADIO HELL

Although he was a very crooked radio-dealer, he was also an ardent radio bug. Between times of selling worthless radio sets, he would tinker on his own perfect sets. But at last he died, and found himself beside the gates of Heaven, where he was stopped by St. Peter.

"I know all about you, Mr. Crooked-Radio-Dealer," said St. Peter "It's down to Hell for you!"

No sooner said than done. The first sight that met his eyes in Hell was a huge number of tables, on each of which was a radio set. Our radio man rushed to the telephone and called up St. Peter.

"Do you call this Hell?" he asked. "Why with all these radio sets down here, I'll certainly enjoy myself better than in Heaven. Thanks for sending me down here!"

Then he rushed away from the 'phone and began trying to tune up the radio set nearest him. No results. He took the set apart. Nothing wrong. He put it together again. Still it wouldn't work. In disgust, he left the first set and tried another. It wouldn't work. After trying out ten thousand sets, he rushed to the 'phone and called St. Peter again.

"Say, St. Peter," he said, "there's nothing wrong with any of these radio sets down here, and yet none of them work."

"Ah!" answered St. Peter, "that's the Hell of it!"—*Isadore Levy.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

ANIMAL ELECTRICITY

SHE (combing hair): "Look, my hair is full of electricity!"

HE: "Why, of course, it's connected to a dry cell." — *Chester Boneczek.*

EVEN THERE

TRAVELER, gazing into volcano: "My, but it looks just like hell down there!"

GUIDE: "Why you tourists must have been everywhere!"—*Joe Milota.*

PART OF THE RAZOR

CUSTOMER: "Waiter, there is a piece of steel in this meat."

WAITER: "I can't help it, sir. It was a razor-back hog."—*Ned Guffey, Reporter No.* 6042.

NOTHING WONDERFUL

COL. STANLEY: "In Egypt the camel often goes seven days without drinking water."

COL. SOURMASH: "In Kentucky folks often go their entire lives without drinking it."—*Morton P. Rome, Reporter No.* 20657.

A PHIAL THAT ISN'T A FILE

The village blacksmith entered the dispensary looking rather white and shaky.

"I've injured my hand rather badly, sir," he explained to the doctor.

The doctor examined the hand and looked grave.

"Thomas," he said to the attendant, "go upstairs and bring me down that phial on the table."

With indignation the blacksmith leapt to his feet.

"File!" he cried. "No, you don't. If this hand has got to come off you'll use a knife or an axe."—*I. Bercovitch, Reporter No.* 27278.

AN ANTI-GRAVITATION SCREEN

MAC: "A man fell from a six-story window yesterday and didn't get hurt."

DUB: "What is he, an aviator?"

MAC: "Oh, no; but he had on a light fall suit."—*Leo Samuel, Rep. No.* 7518.

THE PATENTEE PROBABLY EXPIRED LONG AGO

DUMB: "I don't see them wearing patent-leather shoes any more."

BELLE: "No, the patent must have expired."—*I. Bercovitch.*

CANT-ELOPE

The absent-minded professor was just leaving the zoo after his first visit there. At the gate he was met by the owner of the zoo. As the owner was anxious that all his patrons be pleased, he asked the professor:

"Have you seen my black-faced antelope?"

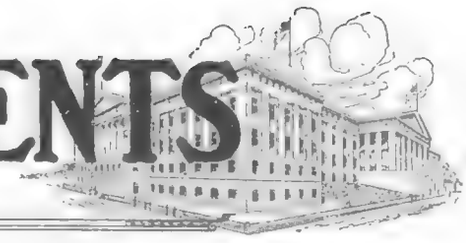
The professor replied, "No, whom did your black-faced aunt elope with?"—*Wilbur Holland.*

WONDER HOW HE'D DESCRIBE A FOG

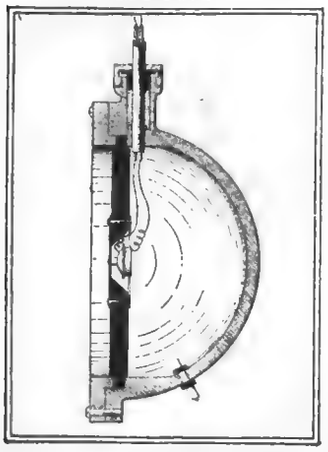
PEST: "Think it'll rain?"

LONG-SUFFERING: "It is quite possible that the saturation of the moisture in the atmosphere has reached such a stage that the temperature might condense the vaporized clouds hovering overhead, but in my belief such a phenomenon is improbable at present because of the extreme height of the clouds, the high temperature, and the close proximity of a lot of hot air.—*Max Bogner.*

LATEST PATENTS

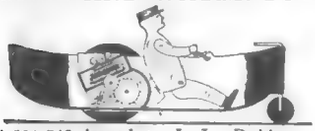


SUBMARINE MICROPHONE MOUNT



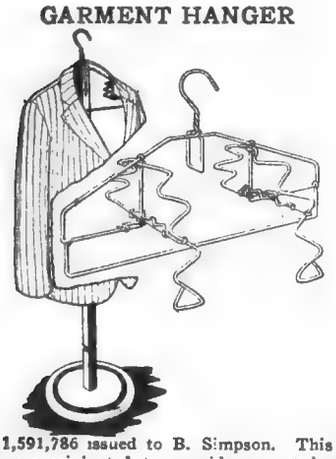
No. 1,591,068 issued to B. L. Williams. The purpose of this invention is to mount a microphone in such a manner that it is made responsive to noises of all kinds rather than to sound waves of fixed periodicity. To achieve this, the microphone is mounted on an elastic diaphragm which has no pitch of its own and is under no stress. The water-tight chamber to the right of the diaphragm may be filled with water to equalize pressures at great depths.

LAND AND WATER TOY



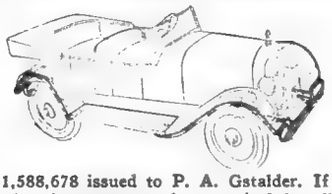
No. 1,591,749 issued to J. L. Dubban. This novel toy, made in the shape of a boat provided with wheels and containing an oarsman, will operate on land and in water. The oarsman is geared to the propelling apparatus—a clockwork motor—in such a way that a rowing motion is imparted to the oars.

GARMENT HANGER



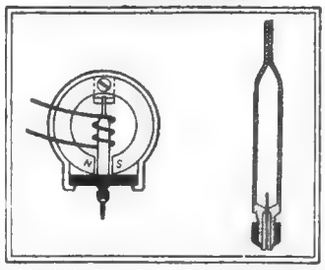
No. 1,591,786 issued to B. Simpson. This device was originated to provide a coat hanger which would hold the garment in a position tending to retain its original shape. A wire frame of the general shape shown above is used as a substitute for the wearer's shoulders when the coat is not being used.

AUTO MUDGUARD PROTECTOR



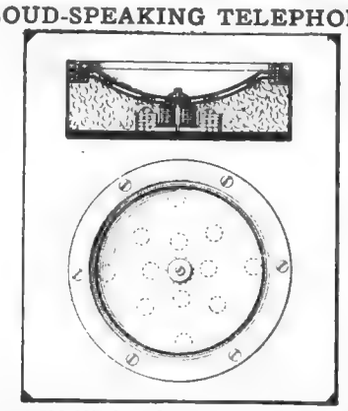
No. 1,588,678 issued to P. A. Gstalder. If this invention is proven to be practical it will be very useful for taxi drivers and all others forced to endure city traffic. A frame is made of the material commonly called strap metal, which is suitably braced and adjusted to the conformation of the fenders. It is intended that the device be made in sections, so that damaged parts may be renewed cheaply. The object, of course, is to prevent the damage of fenders by collision.

ELECTRICAL PHONOGRAPH REPRODUCER



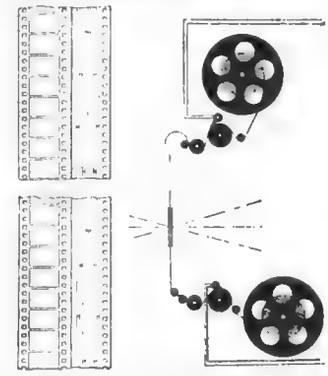
No. 1,591,233, issued to Charles W. Peterson. This is quite an improvement upon the usual Electrical Reproducer. An armature of a paramagnetic material (shown in greater detail at the right) is supported at its upper end by a light spring and imbedded at the lower in a "deadener" of rubber, the armature being surrounded by a coil, and being supported between the North and South poles of a permanent magnet.

LOUD-SPEAKING TELEPHONE



No. 1,588,627 issued to George Seibt. This loud speaker, or rather a later modification of it, has been tested in the laboratories of SCIENCE AND INVENTION magazine, and we have found it very excellent. A cup shaped diaphragm of very thin aluminum has affixed to its center an iron armature controlled by two electro-magnets in the base of the speaker. The entire compartment around the magnets and the back of the diaphragm is filled with goose-down or very fine cotton, which has the effect of preventing the diaphragm from vibrating at its natural period. The unit is quite small, but it produces considerable volume without the use of any sort of horn.

TALKING MOVIE FILM

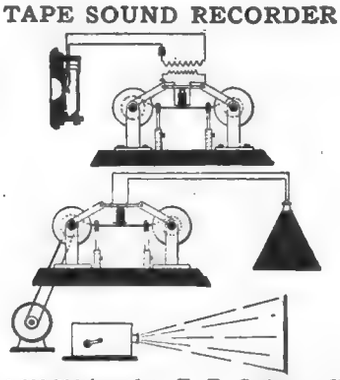


No. 1,591,081 isued to A. L. Curtis. Another one of the very numerous talking movie patents. This time the inventor uses a double width film, with three sets of perforations. The film is designed to carry, as shown at left, either a magnetized Poulsen wire or a lateral-cut phonograph groove. The peculiar looking perforations on the extra half of the film are used to control relays which connect up different sets of loud talkers for different arrangements of the projected scene. The contact apparatus is shown at the right.

STOCKING ORNAMENT

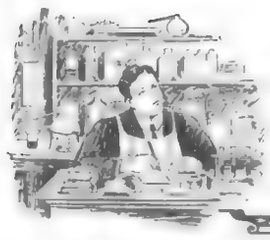
No. 1,589,158 issued to Harry Hedison. Designed for decoration, this device is provided with a celluloid backing-shield which clamps the stocking to it.

TAPE SOUND RECORDER



No. 1,588,706 issued to E. E. Cothran. Here we have a variation of the Poulsen magnetic recorder, recently adopted by a well-known phonograph manufacturer. The same machine is used for both recording and reproducing. At top, the current from a microphone is passed through a transformer and then to an electromagnet, near which a moving steel tape is passed. The ribbon is sectionally magnetized and when repassed through the machine connected as shown below, it causes variations in the magnetic field of the solenoid, thus operating the loud talker.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.



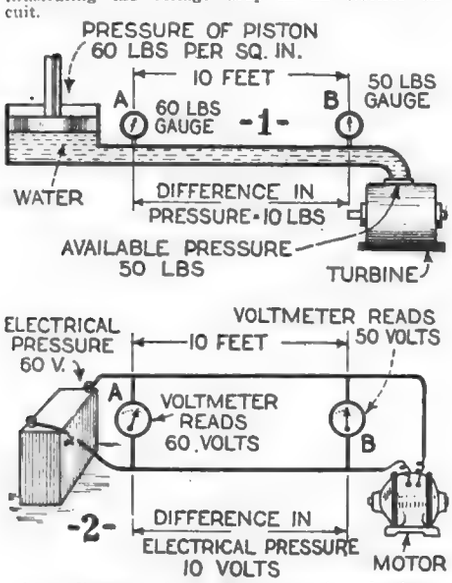
THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

RESISTANCE OF ELECTRIC CIRCUIT

(2130) Q. 1. Edwin Fitch, Asheville, N. C., asks if there is any simple way of explaining or illustrating the voltage drop in an electric circuit.



The diagram above illustrates the simplest analogy which may be employed to explain electrical resistance and voltage drop.

A. 1. In the accompanying illustration will be seen two similar transmission systems, one for water, the other for electricity. In each case, the corresponding apparatus occupies the same relative position. In the upper diagram a pressure of 60 pounds per square inch is applied to water in a cylinder. The water is conducted through a small pipe to a turbine some ten feet away. A gauge inserted at A, near the piston shows a pressure of 60 pounds per square inch, while a gauge inserted at B, near the turbine, registers only 50 pounds per square inch. This drop in pressure is due to the roughness of the interior of the pipe, which causes the water to use up some of its "energy" in making the ten foot journey. The volume of water is not reduced, but the pressure drops ten pounds. In the lower diagram, an analogy is shown in an electric circuit. A voltmeter at the battery reads 60 volts, but after the current has passed through ten feet of resistance wire, a voltmeter reads only 50 volts. The reason for this drop is analogous to the resistance of the water pipe as the wire used as a conductor offers considerable resistance to the passage of electric current and causes a lowering of pressure through the using up of a certain amount of pressure in forcing the current through the wire.

ENGINE CROSS-HEAD STOPS

(2131) Q. 1. John Bennett, Wallington, N. J., asks: Could you tell me how long the cross-head of a stationary steam engine stops? In other words, during what fraction of a second is the cross-head at rest?

A. 1. In regard to the fraction of time during which the cross-head on a stationary steam engine stops during each revolution, we would say that this would vary, of course, according to the speed of the particular engine one has in mind. The time will vary approximately between 1/1000 second and 1/10,000 second. A probable average would be 1/5,000 second.

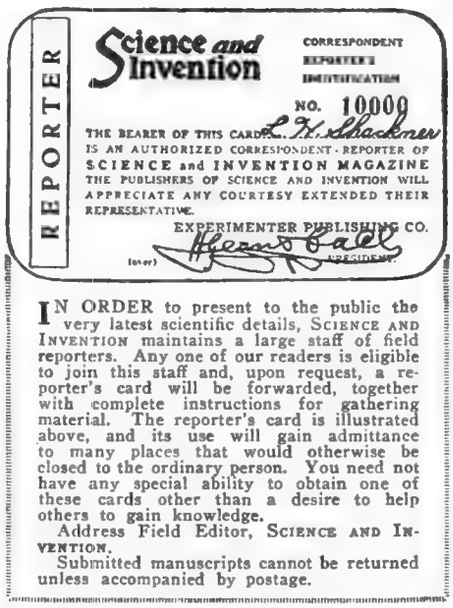
Q. 2. Please give me a process for cleaning tarnished silverware without injury to the finish.

A. 2. If the silverware is immersed in a boiling solution of common baking soda in water, in an aluminum vessel of some sort or in the presence of an aluminum plate, the silverware will be cleaned perfectly without any injury whatever. A new aluminum vessel should not be used, as the interior is discolored and corroded.

WATER-PROOFING CANVAS

(2132) Q. 1. Raymond J. Lucchesi, Merced, Calif., asks for a formula for water-proofing canvas used for a tent.

A. 1. For water-proofing canvas we would advise you to use the following solution. For every gallon of turpentine necessary to treat the amount of canvas you have on hand shave up a half pound of pure paraffin wax. When this is sliced up very fine, dump it into the turpentine which latter should be warm and stir it thoroughly until it dissolves. The canvas can then be soaked in this mixture and when it is thoroughly impregnated with the same it should be hung up smoothly to dry.



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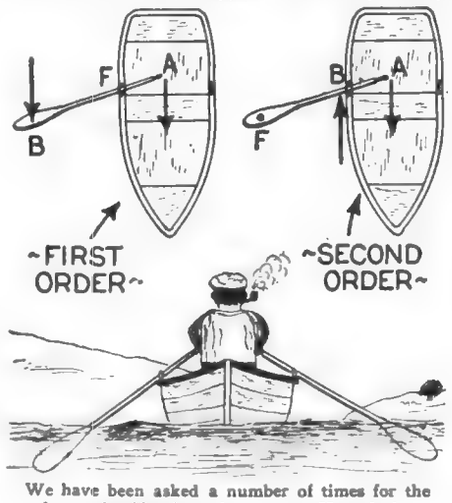
THE OAR AS A LEVER

(2133) Q. 1. Richard Bennett, Evansville, Ind., asks if the lever system represented by the rowing mechanism of a row boat is of the first, second or third orders of levers.

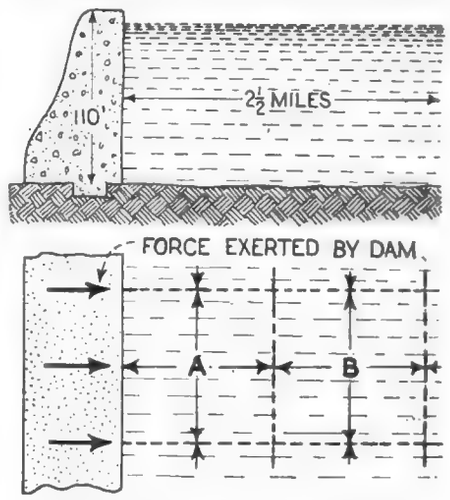
A. 1. This question has been asked several times and every time some argument has arisen as to the accuracy of the answer. In our opinion, there are two possible answers. If the oar lock is considered to be the fulcrum, and the water to be considered movable relative to the boat, then the system may be classified as of the first order. On the other hand, if the water is considered to be fixed and immovable relative to the boat, then the second order applies. It all depends upon the viewpoint of the observer, and either answer is considered correct.



We have been asked a number of times for the lever classification of an oar. Here it is.

DAM DESIGN

(2134) Q. 1. John C. Briggs, Bridgeport, Conn., asks several questions relating to hydraulics. In one of his questions, he asks the total pressure on a dam 110 feet high when the impounded water extends 2½ miles up stream from the dam.



The force of impounded water exerted upon a dam may be computed as shown above.

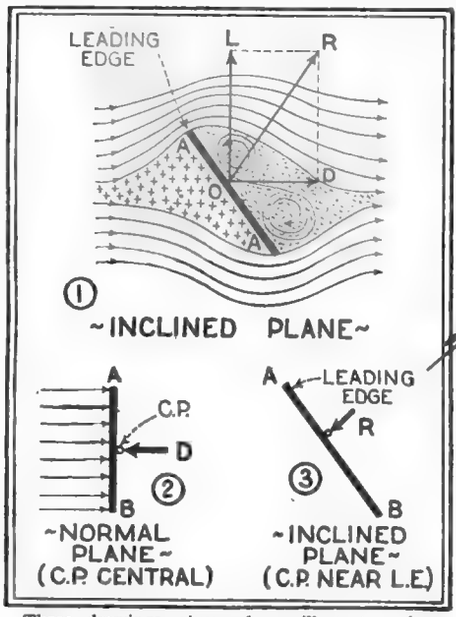
A. 1. This question would be considered by an engineer as follows:

In computing the pressure on a dam, a section through the dam one foot in width is always considered as a unit for computation. Of course, whatever result is obtained for this one foot section need only be multiplied by the total number of feet in the width of the dam to obtain a result for the total length. For every foot of depth, a pressure of 62.4 pounds per square foot is exerted by water. In other words, at the surface the pressure is zero, at the depth of 110 feet the pressure on one square foot of surface is equal to 110 times 62.4 or 6,864 pounds. To find the total pressure over the one foot section, it is necessary to find an average for that depth. The pressure at 55 feet, one-half the total depth is taken as an average. This is equal to 3,432 pounds per square foot. Multiplying this average by the total depth given; 110 times 3,432 equals 377,520 pounds. Multiplying this value by the total width of the dam will give the total pressure over the entire up-stream face. In connection with this question it is interesting to note that the amount of water backed up by the dam, as long as there is no current, has nothing whatever to do with the value of the total pressure on the dam. The reason for this may be seen by inspecting the lower half of the illustration. It is known that pressure applied to a liquid is transmitted equally in all directions. Therefore, we can consider A and B as two isolated "cubic feet" of water, somewhere along the face of the dam. The arrows represent the forces which are acting in a vertical plane. As the pressure at the same depth is everywhere the same in all the "cubic feet," all the forces are neutralized as shown by the direction of the arrows, excepting those of a film of water immediately adjacent to the face of the dam. This explains why it is not necessary to take into consideration the length of the impounding basin.

TRANSFORMER DESIGN

(2135) Q. 1. Roy Zeller, McDonald, Ohio, asks: Give me data to construct a transformer to step down the ordinary 110 volt A. C. current to about 12 to 15 volts and 4 to 6 amperes.

A. 1. The core should be 10 inches long, 6 inches wide with legs 1 inch square. The primary should be composed of 700 turns of No. 15 DCC wire, wound in seven layers. The secondary should be wound with 96 turns of No. 13 DCC wire.



Three drawings given above illustrate principles upon which the aerofoil or airplane wing operates. The principles are discussed in answer to the query below.

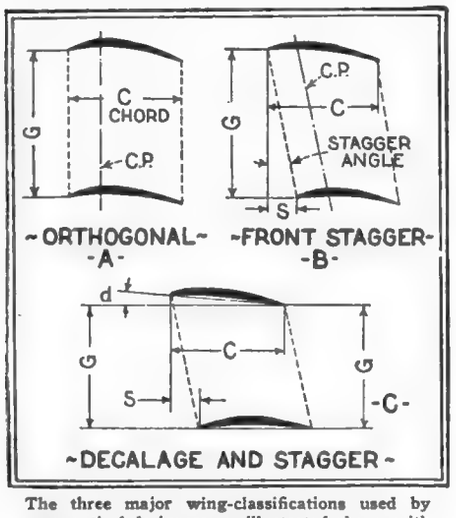
THE AEROFOIL PRINCIPLE

(2136) Q. 1. Mr. Thomas Swanson, Jamestown, N. Y., sent us a sketch of the cross-section of an aeroplane wing and asks us to explain how the wing supports the plane in mid-air.

A. 1. Referring to Fig. 1 of the accompanying drawing, you will see the cross-section of a flat inclined plane AOA which is proceeding in the direction DO, or which may be taken as remaining stationary in the path of air moving in the direction of the arrows. The angle made by the plane with the air stream is commonly known as the "Angle of Incidence." In this diagram, LO is the lift exerted upon the plane, OD is the drag and OR is the resultant of the 2 forces. The progression of the plane AOA through the air stream causes the formation of a partial vacuum represented by the shaded space to the right of the plane. The positive air pressure on the side opposite to this partial vacuum, gives rise to the two forces of lift and drag which must be considered in aeroplane design. The force OD must be overcome by the forward propelling motion of the air-screw, while the lift LO is opposed by the weight of the plane. The point O, termed the "Center of Pressure," lies nearer the leading edge as the "Angle of Incidence" is decreased. In Fig. 2 the "Center of Pressure" of a normal, or vertical plane is seen to be at the exact center of the surface. In Fig. 3, where the inclination is somewhat greater, the "Center of Pressure," at which R operates, tends to approach the leading edge.

Q. 2. Mr. Swanson also wishes to know the terminology employed in common wing design.

A. 2. A glance at Fig. A of the accompanying drawing shows a cross-section of the simple wing arrangement used in the first practical aeroplanes; this type is known as "Orthogonal." In this figure C represents the "chord," or distance between the leading and trailing edges of each plane, while G represents the "gap" or the mean distance between the wings. CP designates a line passing through the Center of Pressure of both wings. Fig. B shows the next development in wing designing, in which the lower wing is "staggered," in other words, placed slightly behind a vertical dropped from the upper wing. In this figure, S represents the "stagger," while the stagger angle is that between the vertical and a line joining the leading edges of each wing. The third drawing, Fig. C, is the type most employed in commercial design. In this type of wing, a new factor comes into consideration. The upper wing has an "Angle of Incidence" which is slightly greater than that of the lower. This difference, called the "decalage," is measured in degrees of arc and is shown at d in Fig. C. This type of design gives an added lift and a considerably greater compression for a given value of drag and chord.



The three major wing-classifications used by aeronautical designers are illustrated above, with the determinants indicated in their proper position.

STRENGTHENING FILTER PAPER

(2137) Q. 1. Mr. Jack E. Brantley, Savannah, Ga., asks: How may filter paper be made strong enough to permit it to be used to filter liquids under pressure, and at the same time make it less likely to tear when wet?

A. 1. When ordinary filter paper is dipped into nitric acid (specific gravity, 1.42), thoroughly washed and dried, it becomes a tissue of remarkable properties, and one that deserves to be better known by chemists and pharmacists. It shrinks somewhat in size and in weight, and gives, on burning, a diminished ash. It yields no nitrogen, nor does it in the slightest manner affect liquids. It remains perfectly pervious to liquids, its filtering properties being in no wise affected, which, it is needless to say, is very different from the behavior of the same paper "parchmented" by sulphuric acid. It is as supple as a rag, yet may be very roughly handled, even when wet, without tearing or giving way. These qualities make it very valuable for use in filtration under pressure or exhaust. It fits closely to the funnel, upon which it may be used direct without any supports, and it thus prevents undue access of air. As to strength, it is increased upward of 10 times. A strip of ordinary white Swedish paper, 1/5 of an inch wide, will sustain a load of from ½ to ¾ of a pound avoirdupois, according to the quality of the paper. A similar strip of the toughened paper broke, in 3 trials, with 5 pounds, 7 ounces, and 3 drachms; 5 pounds, 4 ounces, and 36 grains; and 5 pounds, 10 ounces respectively. These are facts that deserve to be better known than they seem to be to the experimental fraternity at large.

GAS MANTLE MAKING

(2138) Q. 1. Miss Cecelia Brown, Lancaster, Pa., asks: How are gas mantles manufactured?.

A. 1. These are prepared after processes differing slightly from one another, but all based on the original formula of Welsbach—the impregnation of vegetable fibers with certain mineral oxides introduced in solution, as bases of salts, drying out, and arranging on a fiber wick, which burns away in a minute or two of the first lighting.

Lanthanum oxide	30 parts
Yttrium oxide	20 parts
Burnt magnesia	50 parts
Acetic acid	50 parts
Water, distilled	100 parts

The salts formed from the above are dissolved in the water, and to the solution another 150 parts of distilled water are added and the whole filtered. The vegetable fiber wick, (in its knitted or woven form) is impregnated with this solution, dried, and suspended by platinum wire. In the formula the acetic acid may be replaced with dilute nitric acid. The latter seems to have some advantages over the former, among which is the fact that the residual ash where acetic acid is used has a tendency to ball up and make a vitreous residue, while that of the nitric acid remains in powdery form. The wick is stiffened by impregnating with collodion or other organic liquid which dries rapidly.

PERCENTAGE OF EFFICIENCY

(2139) Q. 1. Mr. Luther C. Steward, Washington, D. C., asks us to tell him how the Percentage of Efficiency is determined.

A. 1. Per cent means "by the hundred." A profit of 10 per cent means a gain of $10 on every $100 expended. If a thing is bought for $1 and sold for $2 the profit is 100 per cent; but if it is bought for $2 and sold for $1 the loss is not 100 per cent, but only 50 per cent.

Rule for percentage: Per cent gain or loss is the gain or loss divided by the original cost, the quotient being multiplied by 100.

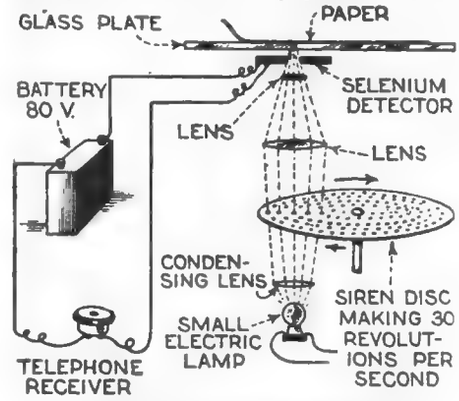
Efficiency is defined in engineering as the quotient "output divided by imput," that is, the energy utilized divided by the energy expended. The difference between the input and the output is the loss or waste of energy. Expressed as a fraction, efficiency is nearly always less than unity. Expressed as a per cent, it is this fraction reduced to a decimal and multiplied by 100. Thus we may say that a motor has an efficiency of 9/10, or 0.9 or of 90 per cent.

The efficiency of a boiler is the ratio of the heat units absorbed by the boiler in heating water and making steam to the heating value of the coal burned. The saving in fuel due to increasing the efficiency of a boiler from 60 to 75% is not 25%, but only 20%. The rule is: Divide the gain in efficiency (15) by the greater figure (75). The amount of fuel used is inversely proportional to the efficiency; that is, 60 lbs. of fuel with 75% efficiency will do as much work as 75 lbs. with 60% efficiency. The saving of fuel is 15 lbs., which is 20% of 75 lbs.

TYPE READING OPTOPHONE

(2140) Q. 1. Mr. John Benson, Baltimore, Md., sends us a clipping from a current publication describing a type-reading Optophone. We are asked to give the details of this invention.

A. 1. Referring to the diagram given herewith, you will see that the Optophone is a device



The components of the type-reading Optophone are shown in the diagram above.

for electrically reading printed matter through the assistance of a selenium cell. The printed matter, is placed on top of a glass plate shown at the top of our diagram. The rays of a small electric lamp are condensed and passed through a siren disk, which interrupts the flow of light as it revolves 30 times each second. The light is then passed through a series of concentrating lenses, and is caused to illuminate that portion of manuscript which is to be read. The light, is reflected back from the printed surface and inpinges upon a sensitive selenium cell, which has the property of changing its resistance under different conditions of illumination. This selenium cell is connected in series with a high tension battery and a telephone receiver. As the paper is moved across the glass plate, and as different amounts of light are reflected by the various letters, a changing musical note is heard in the telephone receiver. Each letter may be recognized by its characteristic combination of sounds which is different from that of any other letter. It is said that a blind man can achieve a moderate facility in reading normal printed matter after about eight hours of practice with this interesting device.

BLOTTING PAPER

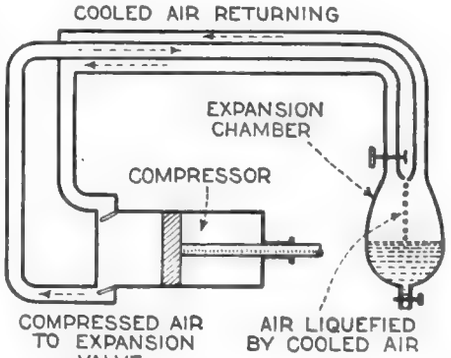
(2141) Q. 1. John D. Lockwood, Washington, D. C., wants to know: If it is possible to combine blotting paper with ink remover, so that the blotter will automatically remove ink marks.

A. 1. A new blotting paper which will completely remove wet as well as dry ink spots, after moistening the paper with water, is produced as follows: Dissolve 100 parts of oxalic acid in 400 parts of alcohol, and immerse porous white paper in this solution until it is completely saturated. Next hang the sheets up separately to dry over threads. Such paper affords great advantages, but in its characteristic application is serviceable for ferric inks only, while aniline ink spots cannot be removed with it.

LIQUEFIED AIR

(2142) Q. 1. Mr. James Collins, Bridgeport Conn., wants to know how air may be liquefied or how it is liquefied commercially.

A. 1. The process of manufacturing liquid air is comparatively simple, as may be seen from an inspection of the illustration given here. For the sake of simplicity, we have omitted from our diagram an inlet for the compressor for additional air, and a water-condenser which removes the heat of compression. As you, will readily see, the air is liquefied by recompression and cooling. The air travels from the compressor through the inside tube to the liquefaction chamber, through the condenser which we have omitted to show, and then back to the compressor.



Portions of the liquefying apparatus shown here were omitted as explained above.

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NO. 44 OF A SERIES

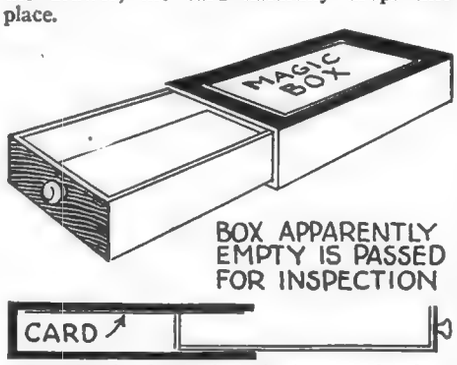
The Wizard's Fan

Small objects can be easily disappeared by the use of the fan provided with a pocket as indicated above.

THIS addition to the magician's kit was originated by me some twelve years ago and I have used the same with signal success ever since. It has, in fact, become an indispensable item in my program. The modern conjurer has, to a great extent, eliminated the long-draped tables from his outfit and therefore finds it difficult to disappear articles of a small nature except with the aid of a few pulls or *servantes*. With this method billiard balls, coins or rolled silk handkerchiefs can be disappeared into the bag arrangement attached to the back of the fan while the objects are being apparently fanned. The fan itself should not be too flashy otherwise it might become unnecessarily suspicious.

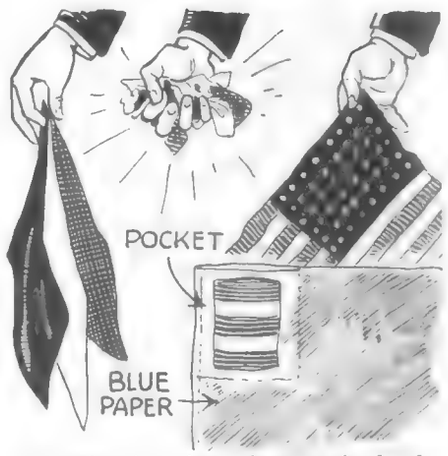
A New Card Box

A BOX of the drawer type sufficiently large to hold a deck of cards is shown. The cards are removed and offered for inspection and the request is made that they shall be shuffled. The empty box is closed and set aside in full view of the audience. A card from the shuffled deck is then caused to vanish and upon opening the box the vanished card will be found in the drawer. This box has a decided advantage over the other forms of mechanical card boxes, in that it is truly unprepared. It will be seen that a duplicate in suite to the card that is forced upon the audience has been previously concealed in the box. The card is held captive between the top of the box proper and the edge of the sliding drawer. In this position the magician may freely display the apparently empty box. On closing the drawer, the card naturally drops into place.



Pushing the drawer into the box permits the card concealed beneath the cover to drop into the drawer.

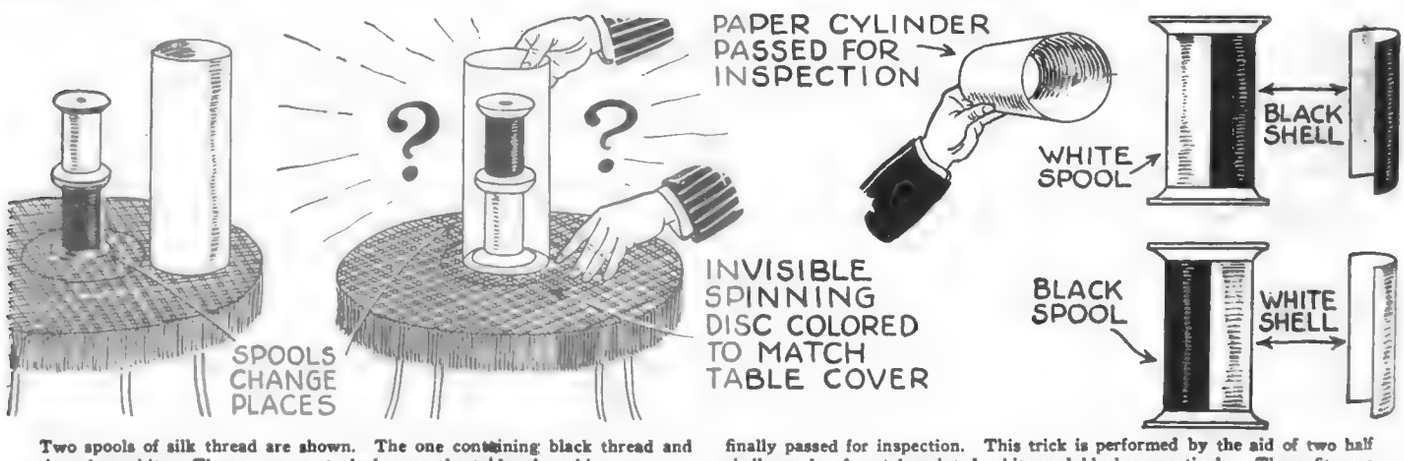
Paper Magic



By tearing three sheets of paper, colored red, white and blue respectively, the magician forms an American flag therefrom.

THE wizard with bared arms shows both hands decidedly empty. He now walks to the table and picks up three sheets of tissue paper each about 12 inches square. These to all appearances differ from one another in color only, one is red, another white, and a third blue. Holding three together, he proceeds to tear them into strips which are then rolled into a ball between the palms of his hands. The papers are again unrolled to form a large American flag of tissue paper. The diagram discloses the fact that the blue paper is not quite as innocent as it seems. In one corner a pocket of a duplicate sheet of paper is formed which houses the folded American flag. The torn sheets are disposed of after the flag is opened.

The Obedient Spools



Two spools of silk thread are shown. The one containing black thread and the other white. They are now stacked upon the table, the white one upon the black. A paper cylinder having neither top or bottom is passed for inspection and is then placed over the spools. On being removed the spools will be found to have changed their positions. Both spools and cylinder are finally passed for inspection. This trick is performed by the aid of two half shells made of metal, painted white and black respectively. These fit over the spools as shown. The revolving disk on which the spools stand is rotated while the cylinder is being slowly lowered over the spools. The shells are palmed when the spools are again examined.

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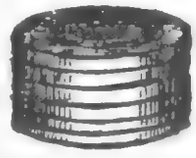

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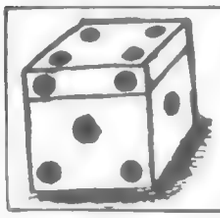

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Into the Fourth Dimension

By RAY CUMMINGS

(*Continued from page* 601)

alert. I had vaguely expected the table, the room, the visible, material objects of the realm I was leaving, to remain unaltered of aspect. But they did not. The table had lost its color; a monochrome of greyness possessed it. The table, the chairs, the whole room, had turned flat and grey. Flat of tone; and flat of dimensions as well. The flat printed picture of a room.

But in a moment even that had changed. The grey outlines of the table were dim and blurred; the grey substance of it, no longer dull and opaque, seemed growing luminous. Faintly phosphorescent. Translucent, then transparent. Through the table leg, through the wavering grey image of the room-wall, I saw opening up to me the vast darkness of an abyss of distance. A phantom room in which I lay. The shadow of a room hovering in empty space.

The pellets were in the palm of my other hand; the glass of water was within reach. Will said earnestly, "One last thing—and this is important—more important than you realize. Whatever comes, we must keep together. Remember that. You two—strive always to keep with me—close beside me. . . ."

There was no horror within me now. That thrilling sense of lightness, that vague unreasoning triumph of loosened shackles had no thought of horror; and to me came a faint contempt for this phantom room, these imponderable shadows which once had been solid chairs and walls.

Then I heard Will's voice. "The battery! Turn off your current, Rob!"

Heard his voice? I believe I barely heard it—physically a thin wraith of human voice striking my ear-drums. Yet, mingled with that realization, was the sense that he was speaking quite normally. With my mind's ear, the *memory* of his normal voice made me hear his hurried, anxious admonition. "Turn off your battery. Rob! Rob!"

My battery. Of course, the moment had arrived when I must turn it off. I glanced down at it. A shadowy, unreal, phantom battery lying beside me; my grey hand resting upon it seemed to my vision far more ponderable. And then I received my first real perception as to the nature of this change. My fingers groped for the switch, found it. But this shadow battery, of which even then I was dimly contemptuous, was solid beyond all solidity of which I had ever formed conception. My fingers fumbling with it—dulled as were my physical sensations. I could feel those fingers groping as though the adamant steel of that switch were *penetrating them.* A feeling indescribable—uncanny, morbidly horrible, though the incident was so brief the horror scarce had time to reach my confused consciousness. My fingers, not the battery, were sha-

(*Continued on page* 636)

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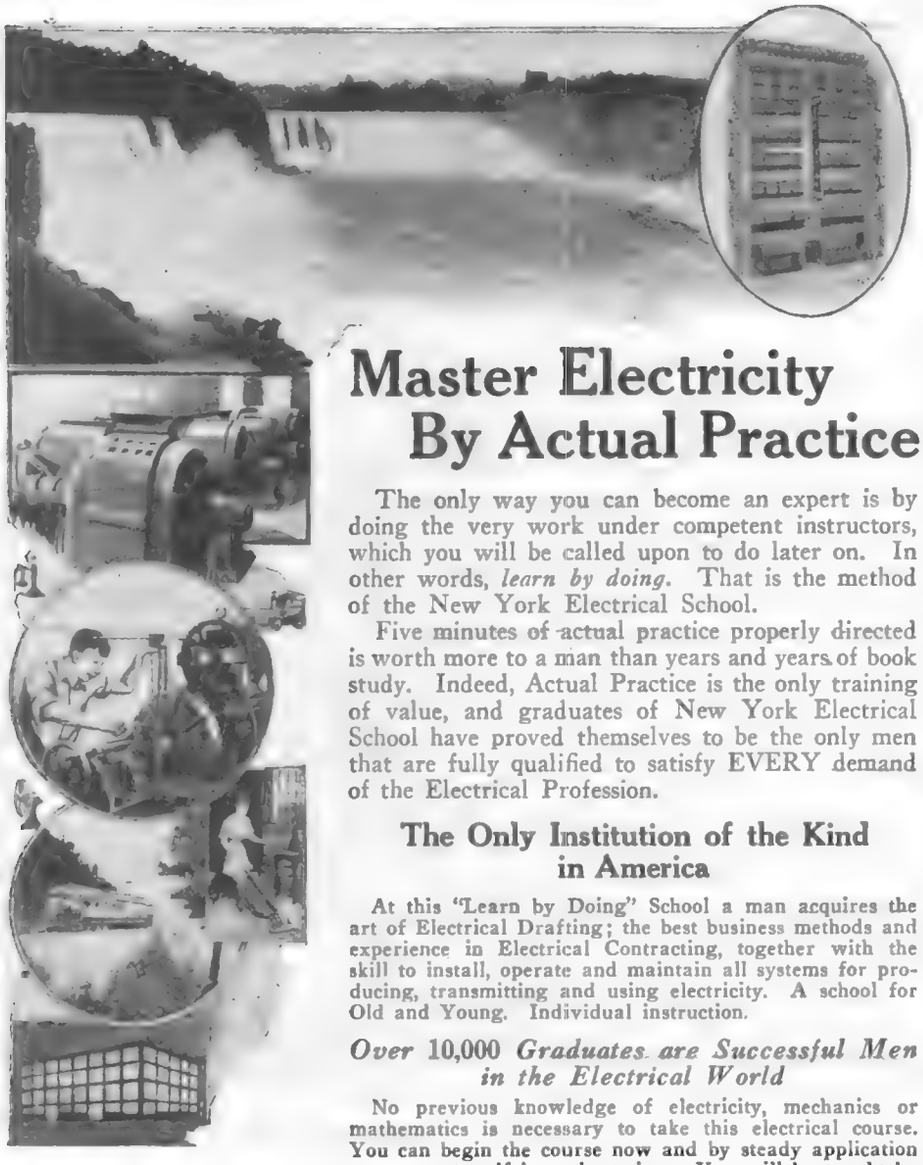

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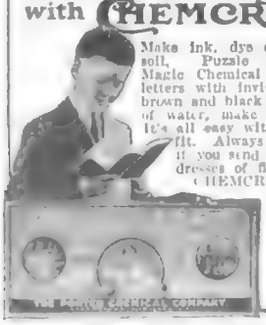

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Into the Fourth Dimension

(*Continued from page* 634)

dow—half ponderable fingers, feeling their way *within the solid steel* of that tiny switch. For a terrifying instant I thought I could not move it. Then—it moved; the current was off. I sank back, exhausted of spirit with the effort. But at once Will's voice aroused me.

"Disconnect the wires. Can you do it, Rob? Quickly—or it will be too late."

I fumbled for the wires; cast them off—gigantic cables they might have been to the futile wraiths of my fingers. Will helped me, I think; and at last I was free, lying back upon the mattress. Dimly I could feel it beneath me, my thrilling, vibrating body resting upon it as though I were a feather newly drifted down.

Moments passed; I do not know how long, I could not have told for my thoughts were winging away unfettered, untrammeled as in a dream . . . A dream . . . the past, the present—all of it savoured of a vaguely pleasant unreality.

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And presently I realized that I was moving; my body—could I indeed call this vanished conciousness of the physical, a body?—my *being* was floating, drifting gently downward, I could no longer feel the mattress; I saw it—a blurred, grey, transparent shadow, coming upward. Beside me, *within me*; then over me as I sank through it a foot or two and came to rest.

Beneath me now, there was a dull sensation. I could feel myself lying upon something apparently solid. Feel it? The feeling was barely physical; rather was it a mere knowledge that I was lying there.

I tried to keep my scattering thoughts together. It was an effort to hold them—an effort to think coherently; an effort to cling to anything—even mental—of reality. I told myself that the change must be nearly complete. *I* was the spectre; this phantom mattress, this wraith of a room—those ghost-like chairs and table floating in space above me—that was my own real world, lost and gone.

A silence had fallen. The hum within me no longer sounded. It was a shock to see that little phantom clock; the movement of its pendulum was visible, but its ticking heart gave no sound. A preternatural silence hung like a grey shroud over a universe of shadows. Then I heard Will's *soundless voice*—heard it clearly now with the knowledge that it was wholly mental, a

(*Continued on page* 638)

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A perfect little typewriter for $1.50. There are thousands of persons who would like to use a typewriter, but whose needs and business do not warrant the expense attached to the purchase and use of a fifty or seventy-five dollar machine. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that anyone can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used are so grouped as to enable one to write rapidly, the numerals 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewritten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large, expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. **Price complete $1.50 by mail postpaid to any address in the world.**

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JOHNSON SMITH & CO., Dept. 365 Racine, Wis.

REAL PISTOL — Miniature Watch Charm Pistol

Shoots Blank Cartridges

Exact reproduction of a real pistol; actually fires Real BLANK CARTRIDGES of miniature size. Illustration is actual size, 1¼ inches long, with ring at end for attaching to watch chain. Loads like a regular pistol. Pull the trigger and it goes off with a loud bang. Pistol is break-open type; illustration shows position for loading. Made entirely of high grade steel, nickel plated, octagon barrel, handsomely engraved handles, complete in box with cleaning rod. **PRICE $1.75.** Also furnished with **pearl handles, $2.50. BLANK CARTRIDGES, 50c** per box of 25.

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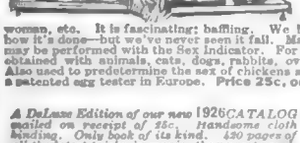

Hold the **MAGIC INDICATOR** over a man's hand—instantly it moves in a straight line, backward and forward. Hold it over a woman's hand and it describes a complete and continuous circle. The same action can be obtained over a letter written by a man or woman, etc. **It is fascinating; baffling.** We have never been able to figure out how it's done—but we've never seen it fail. Many novel and entertaining feats may be performed with the Sex Indicator. For example, similar results can be obtained with animals, cats, dogs, rabbits, over birds, chickens, canaries, etc. Also used to predetermine the sex of chickens and birds, etc., in fact it is sold as a patented egg tester in Europe. **Price 25c, or 3 for 65c, postpaid.**

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Wonderful X-Ray Tube

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. **Price 10c, 3 for 25c, 1 doz. 75c. Johnson Smith & Co.**

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A VERY striking and uncommon ring. Silver finish, skull and crossbone design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, **Good Luck Ring.** Very unique ring that you will take a pride in wearing. **ONLY 25 CENTS.**

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Popular Watch Charms

15c ONLY 3 for 40c; $1.35 doz.

Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

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Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs ½ oz. Made entirely of metal, nickel-plated. **Price 25c postpaid.**

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

Post Paid **25c**

The Magic Flute, or Humanotone, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produce very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument, the effect is so charming as it is surprising.

Novelty Badges

Kissing Permit 10c. Carter Inspector 10c. Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. **10c, each badge, 3 for 25c, or 75c per doz. p.pd.**

BLANK CARTRIDGE PISTOL

Price $1.00 Postpaid

This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard .22 Calibre Blank Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. **A Great Protection Against Burglars, Tramps and Dogs.** You can have it lying about without the danger attached to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. **PRICE ONLY $1.00 Postpaid. Blank Cartridges 22-cal. shipped by express only, 50c per 100. Johnson Smith & Co., Dept. 365 Racine, Wis.**

Sneezing Powder

Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For **parties, political meetings, car rides,** or any place at all where there is a gathering of people, it is the **greatest joke out. Price 10c or 3 for 25c**

Mystic Skeleton 10c ppd.

A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner. **Price per box 10c ppd.**

Microphone Transmitter Button

$1.00 POST-PAID

You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in micro-phones. You can mount the button almost anywhere—card board boxes, stove lopers, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. $5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE $1.00 POSTPAID ANYWHERE.**

ANARCHIST BOMBS

One of these glass vials dropped in a room full of people will cause more consternation than a limburger cheese. The smell entirely disappears in a short time. **10c a Box, 3 Boxes for 25c**

INVISIBLE INK

The most confidential messages can be written with this Ink, for the writing MAKES NO MARK. Cannot be seen **unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle**

ITCHING POWDER

This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more.

10c box, **3** boxes for **25c** or **75c** per doz boxes postpaid.

LOOK 35¢ Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngascope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. **Price, only 35c or 3 for $1.00** postpaid.

RESURRECTION PLANT

One of the most wonderful plants known. Possesses the strange power of turning in a few minutes from an apparently lifeless, dry herb to a BEAUTIFUL LIVING FERN-LIKE PLANT of a dark green color. Simply place the plant in saucer of water, it will open up and start to grow in 20 minutes. When taken out it will dry up and go to sleep until placed in water again. Fine house plant—summer or winter. **10 cents each or 3 for 25c,** postpaid. **Agents Wanted**

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Into the Fourth Dimension

(*Continued from page* 636)

transference of thought which only my imagination and memory endowed with a familiar physical timbre.

"Rob. Come back to us! Hold your thoughts. Stay here with us."

And Bee's imploring voice, "We are here, Rob. All here together. Sit up—look at us—speak to us."

Was I indeed, nothing now but a mind? Were my thoughts all that remained of me? I fought for reality; for stability; fought for anything real that I could clutch, to which desperately I might cling. Where were Will and Bee? Somewhere here in the shadows. An abyss of shadows everywhere. I thought I could see a thousand miles into that pregnant darkness. I could wander in it at will; my thoughts could wander everywhere . . .

But I must have conquered, for I found myself sitting up, with Bee and Will beside me.

"There, that's better." I felt the relief in Will's tone. "Hold yourself firm—you'll

Soundless, colorless phantoms, these streets, trees and houses. I saw the railway station—the ghost of a train stood off there and then moved forward soundlessly. I was touched with a faint amusement to see it—a luminous ghost sliding along its narrow enslaving rails.

be used to it in a moment. It's strange, isn't it? So strange . . ."

Strange; Scarce have I words—and even those I choose are almost futile—to picture what I saw and felt. The world I had left lay all about me—dim, transparent shadows of familiar things. The room of Will's house—we were sitting just below the level of its floor. Around the room—above it, to one side of it—the phantom house itself was visible. Beyond the house, the gardens, the sombre ghosts of trees standing about—a shadowy semblance of the winding village street—other houses—a hill in the distance—

Mingled with all these shadows—the reality I had left—was the reality in which now I existed. The Borderland, we had been calling it. A vast realm of luminous darkness. A rolling slope upon which we were sitting—a slope, something newly tangible at least, which I could vaguely see and vaguely feel beneath me. A realm of pregnant darkness, filled with the shadows of the world I had left; and filled also with things as yet unseen—things as yet unthought . . . The realm of unthought things . . .

Will's voice seemed saying, "So strange—but you'll be used to it presently."

I turned to regard him and Bee—these spectres like myself, sitting beside me. What did I see? What was their aspect to this new mind's eye which was mine? I

(*Continued on page* 640)

BIG --- RADIO --- OFFER

$2 VALUE ..FOR.. $1

This is the biggest opportunity of the year.

To the readers of SCIENCE and INVENTION we have arranged to offer a big reduction in the famous Consrad Pattern's and E. I. Co. Books; millions of these have been bought by Radio Fans. They are recognized and sold by the best Radio stores and Newsdealers.

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☐ No. 9. History and Operation of Vacuum Tubes.
☐ No. 10. The Neutrodyne and All About It.
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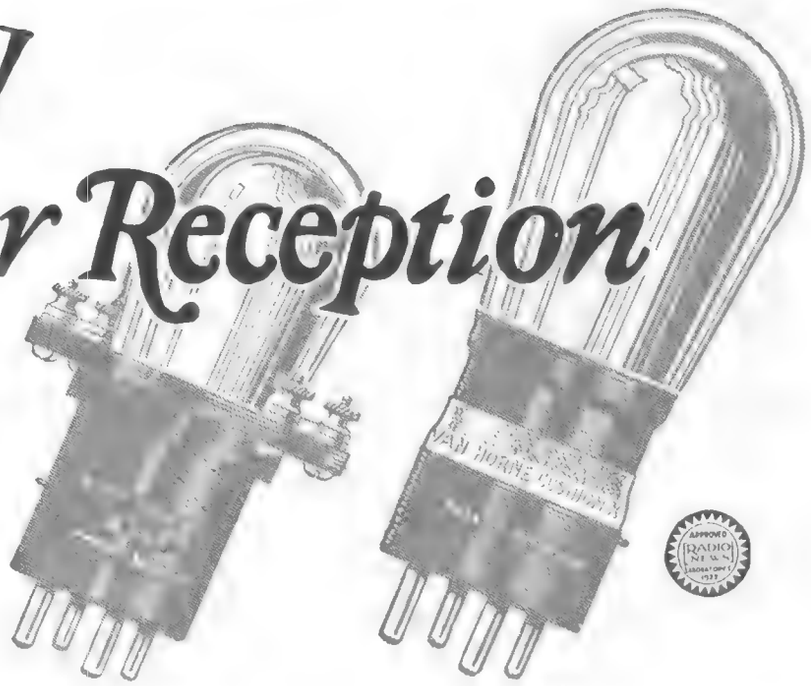

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"At this time they have been given approximately 600 hours of service and they are maintaining their useful characteristics in a remarkably high degree."

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"The set was equipped with Van Horne Cushion 5 VAX tubes. Their installation eliminated all noises excepting those of summer static. As the night advanced and the static decreased the full value of the tubes became more apparent."

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"Let me congratulate you on the splendid performance of the Adapted Mogul 5 VCX Amplifier tube. I found these tubes give remarkable amplification and clarity. The tube actually gives considerable increase in volume when used without additional plate voltage or grid bias but when 135 volts is applied to the plate the volume is virtually doubled."

Distance
Minneapolis, Minn.

"The results of your tubes have pleased me so much that I feel it necessary to write to you and express my thanks. I wish that everybody knew the difference; I am sure they would never have any other type in their receiver.
"A friend of mine had been complaining of set as to long distance reception and asked me over to look at it. I went over and after carefully surveying his set found nothing wrong with it but suggested he try some of your tubes.
"The first evening after installing he received New York, Mexico City and several others he had never heard before with sufficient volume to be heard all over a seven room house. Now please remember the only change he made was in the tubes and that the others he was using were a well known standard type. Feeling this incident alone is enough to convince anyone I won't mention any of the others. They are too numerous. I will back these statements up as will several of my friends, to anyone who care to write to me."

*Names of the above furnished upon request.

Van Horne tubes are built with but one purpose in mind—to give to the set user really dependable tubes—the kind that last long and serve him best.

The two unusual tubes above will make a decided improvement in your reception—they are built to give greater volume, realistic reproduction of voice and music and to eliminate vibration and other conditions that impair reception.

One of these, the Adapted Mogul 5 VCX power tube has unusual signal and current carrying capacity. Its use in the last audio stage gives to reception a fullness of tone and clearcut reproduction of voice and music—a great improvement in your set—without a change in wiring.

Another unusual tube is the Cushion Base 5 VAX. In the base of this tube is a soft rubber cushion which completely absorbs all vibration resulting in the elimination of harshness, humming and microphonic noises. Knowing how much vibration impairs the tone quality of reception, fans everywhere are equipping their sets with cushion base tubes. Equip your set with Cushion Base tubes and note the surprising softness and fullness of tone of reception that follows the elimination of vibration.

To fully protect the user of Van Horne tubes an unconditional guarantee is made. This guarantee provides for the immediate replacement of any Van Horne tubes that in any way prove unsatisfactory.

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However, if you have already heard the Saw, and do not want the record, ask only for my big FREE TRIAL OFFER with which all my pupils have made their start to fame and money. No charge; sent postpaid. Simply mail me this ad with your name and address printed along the margin.

MUSSEHL & WESTPHAL
337 West Water St. Fort Atkinson, Wis.

Into the Fourth Dimension

(Continued from page 638)

cannot say. I think now that my intelligence saw the intelligence which was theirs, and clothed it out of habit with a semblance of substance for a body—familiar of outline and form since there was none other aspect I could conceive. I saw—or thought I saw, which perhaps is quite the same—luminous grey ghosts of my companions as last I had seen them. Of themselves they appeared not transparent. Through them the spectral walls of the room were not visible; of everything around me the bodies of my friends seemed the most real.

Will was smiling at me reassuringly. Bee's gaze was affectionate. Their voices, save that I knew I heard no sound, seemed not abnormal. I spoke. It was like thinking words with moving lips. But they heard me; not to read my lips, but to hear my thoughts. Heard with a result quite normal, for they nodded and smiled and answered me.

Then Will touched me; experimentally with a smile, he laid his hand upon my arm. It was not unreal, save that only dimly, as though my senses were dulled, could I feel him. Yet there was a blessed *weight* to his grip. His tenuous ghostly fingers (as I would have counted them in my former state) were not ghostly of grip to me now. His fingers, my arm, were identical of substance. His fingers could not occupy the space with me; they were ponderable, real, with a dulled but blessed reality which gave me at last something to cling to; brought my scattering thoughts together. I was here—Robert Manse; alive—living, breathing.—sitting beside my friends. From that moment a measure of the strangeness left me and took to itself the externals only. *I* was real; Bee and Will were real; it was only the things around us which were strange. The body which momentarily I seemed to have lost, was restored to me. A sense of the physical; dulled of perception, but still a body to house my mind. To house it—yet not to hold it firmly. A body which now was not a prison; shackles fallen away. Yet there was a danger to that. Already I had tasted of it—for the mind, too free, is difficult to control . . .

I was saying, "I'm—all right . . . I was dreaming—I got confused."

Bee said whimsically, "We're here. Will, there is so much I want to ask you—"

(Continued on page 646)

Articles In November "Radio News"

$500 Prize Cover Contest
A Superhet Travelling Companion.
By Herndon Green

The Pianorad.
By Hugo Gernsback and Clyde J. Fitch

An Auto-Balanced Receiver.
By Clyde J. Fitch

A Lamp-Socket-Operated Browning-Drake Receiver.
By Arthur H. Lynch

Socket Arrangement for a CW Set.
By Charles F. Felstead

Radio-Frequency Amplification.
By E. T. Flewelling

A Battery-Coupled Amplifier.
By Clyde J. Fitch

Transformer-Coupled Amplifiers.
By Sylvan Harris

A 10-Tube Receiver of Advanced Design.
By H. B. Waffen

Radio Batteries and Their Care.
By M. L. Muhleman

New Developments in Radio.
By G. C. B. Rowe

From Coal to Electrons.
By Boris S. Naimark and D. M. Morandini

"Came The Dawn"—A Scenario.
By C. Sterling Gleason

$50 Wrinkle Prize Contest Awards.

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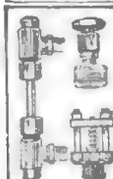

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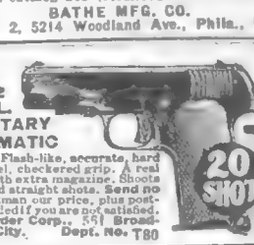

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Patent Advice

Edited By
Joseph H. Kraus

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Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

SCALING LADDER

(970) M. B. Hinds, Gladstone, Oregon, submits a drawing of a scaling ladder to be used by fire fighters which has a pair of jaws at the top operated by a lever at the bottom of the ladder, the purpose being to grip a rafter or other beam. He asks our advice.

A. We do not see how your fire ladder presents any marked improvement over those fire ladders now in use, and as a matter of fact we believe it to be much inferior to present styles. The reason for this is that your ladder can only be clamped to wood rafters, steel or angle iron beams. Ordinarily, wood rafters and angle iron beams do no extend from the walls of a building and consequently it would be impossible to fasten the ladder which you have designed to any construction and expect the device to be safe.

Incidentally, you place a lever at the bottom of the ladder to clamp the spikes together. With this construction it is impossible to do any scaling because the climber must go down to the bottom of the ladder again to release the lever before he can shift it to a new position. We do not advise that you apply for a patent on the same.

BATTERY HYDROMETER

(971) Ray Brown, Cobourg, Ontario, Canada, asks our advice on a small battery hydrometer made to fit the filling cap holes.

A. The idea of placing a hydrometer or other indicating device in the cells of a storage battery is very old indeed. The mere fact that you have made use of the well-known principle of differently weighted balls for indicating the condition of the electrolyte in a storage battery does not give you ground for application for a patent. Because of the age of the idea we would advise against your investing any time or money in it.

An accurate check cannot be obtained through the filler holes, particularly when water has been added to the acid to make up for evaporation.

A market could undoubtedly be found for a good individual cell hydrometer giving accurate readings.

HELICOPTER

(972) M. Vermont asks for advice on a vertical rising airplane having a plurality of engines, propellers, etc.

A. There is no doubt but that your airplane, if properly controlled, would work; the difficulty is that the various motors you have for producing a vertical rise or lift are all operated by separate engines, and consequently their speed will vary and because it so varies the vertical rise will not be even, and the possibility is that the machine will upset, causng destruction to the aviator and the apparatus itself.

You have also not taken into consideration the weight of the many engines and methods of control.

We certainly would not suggest that you apply for a patent on the idea.

SCREW, ROTARY GAS ENGINE VALVE AND AUTO SPRING

(973) Henry L. Lay, Helena, Mont., requests patent advice on a screw which can only be driven into the wood because of the peculiar arrangement of the slots at the top, but which cannot be removed therefrom; a gasoline engine valve of the rotary type and an automobile spring of peculiar construction.

A. Two of the systems outlined in your communication, in which you request patent advice, are not new. These are the screw and the rotary valves for gasoline engines. The automobile spring may be of value although we do not see how this possesses any material advantage over other devices and would suggest that you give us further details concerning its possible operation and its position on the chassis of the automobile before we advise further.

SUPER-FASTENED SHIRT COLLAR

(974) Chester Hetrick, Gilbertsville, Pa., requests patent advice on a shirt and collar which s to have a plurality of buttons on the shirt and a plurality of button holes in the collar, the object being to make the collar stick to the shirt more closely than in present constructions.

A. You have evidently never attempted to attach collars to a shirt in the manner you describe; otherwise you would have found that the suggestion was extremely impractical. The difficulty of removing the collar from the shirt and reapplying it is bad enough with only one button, and it would be infinitely worse with a group of buttons. In addition to that collars seldom fit exactly. Some times the shirt is tight and other times loose and this would necessitate long holes in the collar itself to permit buttons midway between the ends and the center to position themselves accurately. We certainly do not suggest a patent on this idea, as we do not see how it can be made commercially practical.

FOREIGNER DESIRES AMERICAN PATENT

(975) Hirao Sampei Shoten Factory, Honjoku. Tokio, requests advice as to how he can secure a patent in this country.

A. The best way to secure a patent in this country is to send the details of your device to a patent attorney and let him take care of the matter for you. You will find that any of those patent attorneys advertising in SCIENCE AND INVENTION Magazine are thoroughly reliable, inasmuch as we have taken the trouble to carefully investigate all of them.

The cost of a patent varies from $100 up, depending upon how many drawings have to made, how many specifications will have to be listed and how many claims the patent office will allow. Also, if the patent goes through without interference the cost is considerably less than if the attorney must fight the case.

Our suggestion would be to have drawings of your invention made and also send complete specifications of that invention to an American patent attorney and have him make a search. This search will cost approximately $10.00, and it will reveal whether or not similar patents have already been taken out on identical processes. After this, you may decide on whether you intend to go further and prosecute for the patents.

ALCOHOL MANUFACTURE

(976) D. DeWald, Orlando, Florida, asks us as to how much alcohol he will get from farm by-

(*Continued on page 644*)

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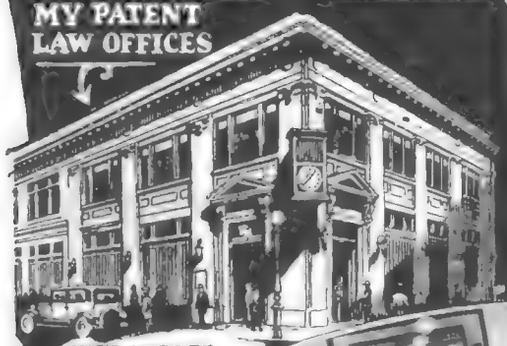

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Patent Advice

(*Continued from page 642*)

products, such as potatoes, carrots, beets, grass, oats, barley, rye and wheat. He also wants to know whether or not we would think it profitable for him to enter upon the manufacture of alcohols for fuel purposes, and what the possibility of marketing the alcohol would be.

A. It would be very difficult for us to approximate the price for methods in the production of alcohols for motor fuel, from raw products. This will depend largely upon the scale at which you intend to carry on the work. The first thing that would be necessary would be a device to completely macerate the raw materials. This may be a pair of rollers revolving in opposite directions, from which is squeezed or pumped the material, and also a form of chopping machine, varying in size from a small hand-driven meat-cutter to a large macerating rolling machine. The mash is now placed into vats to which water is added, and the vats should preferably be screened, although this may not be necessary in the case of motor fuels. A cover is always advisable because there are some bacteria which will cause a decay of the products before fermentation is complete. The mash is now permitted to remain in vats for approximately fourteen days, after which the liquid is pumped to the stills. Here distillation of the alcohol takes place and again the size of your retort will depend entirely on the size of your business endeavors. If the stills are large and many of them are to be employed, steam could be used to cause the distillation. This method would be simpler than the direct flame, and would be much safer. With some carburetors alcohol can be used directly, with others the jets would have to be changed and possibly some means added to volatilize the fuel. A license for the distillation plant would be necessary.

OMITS PARTS OF CONSTRUCTION

(977) Henry A. Hardy, Topeka, Kansas, has obtained a patent on an article which works better if he omits one of the pieces of its construction. He wants to know whether he should secure another patent on the same idea omitting this piece of apparatus and wants to know if there is any direct necessity for applying for further protection.

A. Generally, the claims of a patent are developed so that the simplest ones come first and the more complicated ones appear later. If you find that your device will work just as well omitting one of the pieces on which you have not based a claim, and if your patent was not obtained on the strength of this small part, we believe that your patent might be just as basic as it was before.

Not knowing the nature of your patent and also not knowing how many other patents there are on this particular subject, we would not be in a position to advise you more fully. Why do you not take up the proposition with your patent attorney, who, we are confident will be glad to advise you as to whether or not your are fully protected?

Our own opinion is that your present patent will cover the idea as thoroughly as if you secured another patent on the same subject under an improvement thereof.

Puzzle Lamp Circuit Again!

GREAT interest has been evidenced in the Puzzle Lamp Circuit published in SCIENCE AND INVENTION for July, 1926, on page 238. The editors have received numerous letters from correspondents who have tried out the circuit as it was originally published, and the great majority of letters indicate that trouble was found in getting the set to operate. One man wrote in that he had spent two days and one night in trying to get the circuit to work, while another said he had burned out 37 fuses in his vain attempts. Such reports as these prompted the editors to assemble the apparatus in two different forms for test, to permit a check-up of the circuit and to find out just what switch combinations would light the center light.

In checking over the article by Mr. William B. Taylor, which contained the original circuit, it was found that an error had been made in the designation of the type of switch to be used. As a matter of fact, the text of the article was quite correct from the viewpoint of an English engineer, who calls the standard four-way snap switch by another name; to him it is a three-way switch, and was so called in the article. This correction was made in the August

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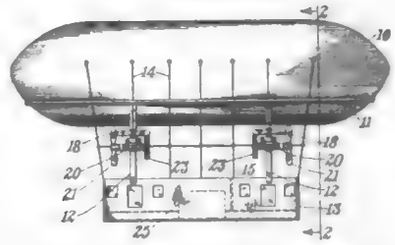

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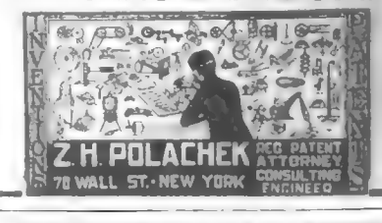

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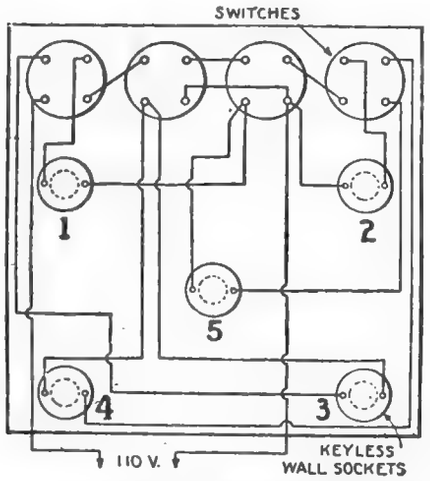

Fig. 1. Here is the authentic circuit of the Puzzle Lamp which has caused so much interest.

issue, and we then built up the circuit with the correct four-way switches.

The diagram of connections for the Puzzle Lamp Circuit is repeated in this column, together with two photographs of one of the test sets built in our laboratories. The circuit, Fig. 1, is exactly the same as the one originally published, and has been found correct. Fig. 2 shows the test set as assembled and wired by us. The outside sockets are in two units of two sockets each for greater compactness, but the middle socket is a single. By tracing the wiring as shown

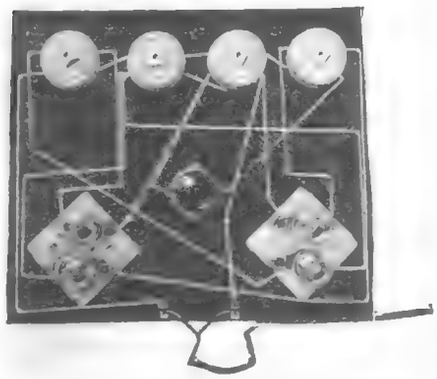

Fig. 2. Our laboratory test set.

in our photograph, you will see that we have followed the circuit exactly. Fig. 3 shows the set with the tops of the switches and the light bulbs removed, the better to show the connections.

This set was tested with every possible combination of switches (and by the way there are just 16 combinations), and not a single short occurred. All damage to the house lines and fuses may be prevented by inserting a 100-watt lamp in series with either of the leads from the socket.

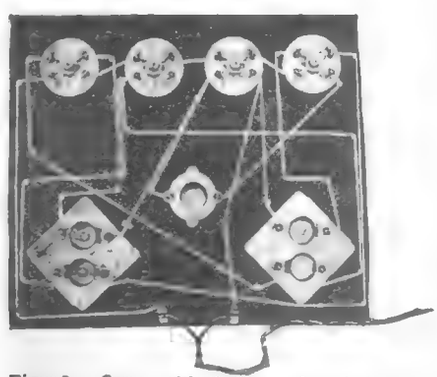

Fig. 3. Same with bulbs and switch-tops removed.

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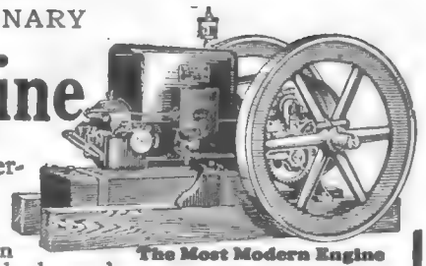

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Into The Fourth Dimension

(*Continued from page* 640)

"Not now, Bee." His voice was full of its old decisiveness. "We must start. Keep together—you understand now Rob, what I meant. Keep together—keep thinking, firmly, what you are doing. And do—what I do. We must start."

He drew himself erect. As though I were dreaming—or thinking of the act—I felt myself standing erect. Then walking—vaguely I could feel the substance of the slope beneath my feet—walking with a lightness, a lack of effort weird but pleasant. And I clung physically to Will, and saw Bee on his other side clinging to him also—as though a breath of wind might blow us all away.

The thought was whimsical. There could be no wind. Wind was moving air. I had the sense that I was still breathing, of course. But how could there be air? Air itself was infinitely more solid than these, our bodies. Yet I was breathing something. Call it air. The word of itself means nothing—and there are no words with which to clothe the realities of an unthought realm . . .

We were walking through the phantom room which had been the reality of Will's home—through its wall—out through its garden. Our slope was rolling, uneven. The shadowy ground of the garden was above us, then below us; then, for a moment, we seemed standing exactly on its level. I remembered. This was the place Will had mentioned to which we could safely return.

We spoke seldom; Will did not seem to care to talk. I realized he knew where he was going—had some definite purpose in his mind. Alert now with every mental faculty, I wondered what it was, yet would not question him.

We stalked onward. The shadowy village lay about us, above us now. Soundless, colorless phantoms, these streets, trees and houses. I saw the railway station—the ghost of a train stood off there and then moved forward soundlessly. I was touched with a faint amusement to see it—a luminous ghost sliding along its narrow enslaving rails. It could not go up or down, or sidewise. And it seemed so imponderable I would fearlessly have walked into it.

This Borderland, full of these shadows of our other world, yet seemed empty. Nothing of its own reality was visible. In every direction I could look into seemingly infinite distance; and overhead was a vast darkness—the emptiness of infinite space. Was nothing here with us in this Borderland? Those other spectres—those beings coming out from their world as we were coming in from ours? . . .

A thrill of quite normal excitement swept me at the thought. We had come in to encounter those spectres. And now they would be spectres no longer. Ponderable beings upon an equality with ourselves; and we were here to thwart them of their purpose . . .

I heard Bee give a faint, alarmed cry. Ahead of us a shape had appeared! It became visible and I felt that perhaps it had been hiding behind some unseen obstacle. It stood, solid and grey, with the shadow of a barn, a haystack above and behind it. Stood directly in our path, as though waiting for us.

I pulled at Will, but he ignored me. Hastened his pace.

We stalked forward with that waiting thing standing immobile in our path!

—END PART 3—

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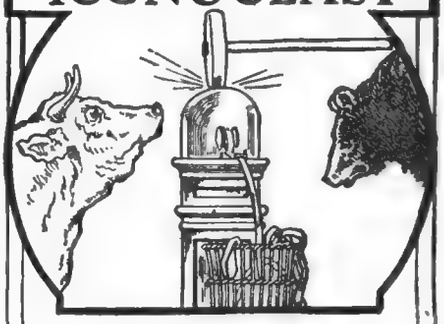

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The Meaning of Music

By CHARLES D. ISAACSON

(*Continued from page 622*)

to describe, hard to make you feel. It is something you must experience for yourself, and once you have caught it, you will never misunderstand again. Those of my readers who have been thrown into an ecstacy by a phrase of music, by the lilt of a melody, or the deep emotional intent of a chord, know what I mean. Perhaps it will help others, if I tell you this:

Great music is not recognized as such by a trick or a freak of fate. We do not put our hand into a grab bag and say "Number one is great, number two is not—now let us see, number one is Beethoven's Moonlight Sonata; number two is Hot Mamma." Oh no! We term a thing of music *great*, only after it has been tried by time and found not wanting.

I will give an absolute test by which each of you can judge for yourself the greatness of a book, a musical composition or any artistic production. *How long can you hear it?*

THE TEST OF TIME

Think back a moment now. What song was it you were singing a while back—some popular music, ballad, ragtime blues, or something else? Where is it now? Do you feel you couldn't bear to hear it again? You know the sort of music—which when you heard it first on the radio, you thought it was the cat's!—which after a while, you couldn't stand! Well, that is *not* great music.

But now, think of some lovely song you have known for years, which continues to thrill and move you. It need not be one of opera, or concert. Perhaps it is "Annie Laurie," or "Ben Bolt," or "Believe Me If All Those Endearing Young Charms." That's great music.

The secret of it all is plain. The more the composer *felt* when he wrote, the more you *feel*. If he was deeply stirred and had the genius to express that emotion, you will feel it too. You can't expect a man who writes a song to sell it, and who is most concerned about his royalties and how the public will "take it," to be very happy or sad in his mood of creation.

Franz Schubert never made anything out of his songs. But he wrote them because he would have burst with them if he had not let them out. Schubert is immortal. Jack Jones, whose red-hot song is just off the press, may make a million, but he'll not be remembered long.

THE LANGUAGE OF MUSIC

A moment ago, I said that you feel what the composer felt. Yes! The more as you are able to listen with imagination wide open. Perhaps you don't know how to do that. Perhaps, like so many others, you are in the habit of fighting relaxation and imagination. An infant, who has no "repressions," will cry or laugh according to the mood of good music. Little children will tell you the story they "see in imagination," while they hear it.

Every good piece of music is telling a story; I won't take the time and space here to go into the how and why. Another month I shall. But in the meantime I've prepared a book for the New York Edison Hour, which WRNY broadcasts each Tuesday night. It is called the "Arabian Nights' Radio Entertainment," but I really might have termed it "Moods in Music." It gives twenty or more programs of Edison Hours, each of which is devoted to a mood or picture. It brings into actual expression that something which is hinted at above. It shows how to use your imagination in listening to music. After you've heard just half of the Edison series, you'll never again be

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Now for a pause, and a glance back over the month at our station. It's always good for us, as well as you, to accumulate some of the big things and see how they look in a tabloid paragraph or so. They say that Caesar had his Ides of March, but that program directors have their August; which is to indicate that the worst time of the year is the month just passed for us. (As I write these words, September has just begun). Well, is this so bad?

SONGS OF FAR-AWAY LANDS

Lina Abarbanell! She who delighted the audiences in "Madame Sherry," "Merry Widow," and so many other successes of light and grand opera—she was a pretty little Hansel in "Hansel and Gretel." And there was John Quine, the American concert baritone. There came Ragani Devi, of the Hindu temples of Cashmere—came with the anklets, bracelets, necklaces, earrings and even the diamond in her nostril—came with the long-stringed, lazy-languorous-toned tambura and the brighter sitar—came with the atmosphere of the bazaars and the Orient. The night Ragani Devi sang and danced, Yugi Hirose of Japan intoned the melodies of Tokio and the cherry-blossomed interior of the island. But perhaps the biggest individual appearance of the month was that of Vincent Ballaster, the greatest singer of Spain, and probably in many respects the greatest living lyric baritone. Ballaster and Galli Curci, Ballaster and Mary Garden, Ballaster and Martinelli—these have headed the bills of the Metropolitan and Chicago Opera Companies. It would be lacking in taste not to mention in this same paragraph, John Barnes Wells, tenor and composer. For Wells, Ballaster, Huarte, Devi, Hirose, Quine and Abarbanell were soloists with the Edison Ensemble.

A new and beautiful ensemble of music has been added, with Theodore van Yorx at the helm. And speaking of beauty, we must record that Rita Montaner, one of the loveliest women of Cuba, was a unique broadcaster over WRNY, with Xavier Cugat as her accompanist.

By the way, did you hear Dr. Sigmund Spaeth? The distinguished critic has turned humorist in music. He is disinterring old songs which now sound so ridiculous; it's part of his book, "Words and Music." One chapter which Dr. Spaeth broadcast is "The Great American Opera," which, like goulash, has everything in it.

"The Scamps" came back. You saw their picture last month; they are the boys of the S.S. Majestic. And how they can play jazz! Harold Loomis' Orchestra is another fine dance number on WRNY's programs.

THOSE NOVELTY NIGHTS!

One was "A Night in Mexico," and none other than the members of the Mexican Consulate, if you please, were over to conduct it. Another great Novelty Night program, and one which is likely to go down in history, was the René Fonck tribute. That night at WRNY, in The Roosevelt studio, we toasted Fonck over the air. The President of the United States, the Governor of New York State, the Mayor of New York City, the Ambassador of France, all sent gracious messages. Hon. Nelson Ruttenberg spoke for the State of New York; Consul-General Maxime Mongendre for France; Col. Harold Hartney, of the Argonauts, Lieut. Allen P. Snody, who accompanies Fonck; Walter Wellman, who made the first attempt at trans-Atlantic flight; Viola Gentry, the aviatrice who flew under the Brooklyn Bridge, and many other distinguished guests were there. And Capt. Fonck described his route, as he plans to make the hop. (There was an informal touch which

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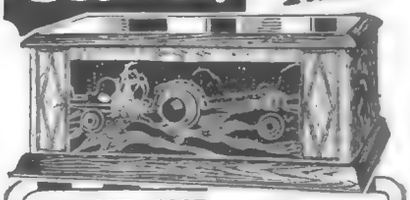

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followed the tribute. Georgette Nyrielle, who sang the "Marseillaise," is the daughter of a famous maker of wedding and ceremonial cakes—her mother made a huge Aviation Cake, and Miss Nyrielle presented it to Capt. Fonck).

Another Novelty Night was a Civic Repertory Theatre gathering. Eva Le Gallienne, the gifted founder and director of the theatre, was on hand. S. Jay Kaufman of "Round the Town" of the *New York Telegram*, and president of the Green Room Club, was a speaker. He was himself, which means he was fascinatingly interesting. Beatrice Terry, niece of Ellen Terry, was another brilliant speaker. Clementi Giulio of the Fourteenth Street Theatre, where the Civic Repertory is to make its home, told of the historic memories of the house. The company is giving great plays at nominal admission prices; and radio fans who want to see them are invited to join the Radio Unit. Write to Miss Le Gallienne or to me at WRNY.

A BIT OF EVERYTHING

Another novelty was Birdie Reeve, the girl with the typewriter. As fast as an assembled group could mention names of prominent men—Roosevelt, Wilson, Lloyd George, Hughes, etc.—she quoted from memory a speech of theirs, and typewrote it at the same time. Then she wrote one address while speaking another; she played a game of chess, while doing everything else. And Birdie is only sixteen and uses only two fingers of each hand to typewrite—and she beats the world's champion.

Have you followed the Saturday morning symposiums? I'll tell you more of them next month. But just this much now: We had Deputy Attorney General Reba Swain, Col. Beard, Harry Mayer (who started the Hall-Mills case all over), Bert Berger, Creté Hutchinson, Jessie Tarbox Beals, Maurice Livingston, Hetty Cattell, Joan Lowell, Irene Kuhn and many others.

Each speaker talks for five minutes on his or her special work. Then I ask a crazy question like "What's going to happen in the Hall case?" or "What do you think of Pola Negri?" or "State your views of the Mexican Catholic situation"—and without preparation, each one gives a live comment. It's lots of fun. Intellectual impetus, as "Pioneer" of the *New York Herald-Tribune* calls it.

In closing, I give you another scoop. Congressman Fiorello La Guardia has spoken twice, and is scheduled for every other Wednesday night, to talk on live political questions.

Who said August is so dull?

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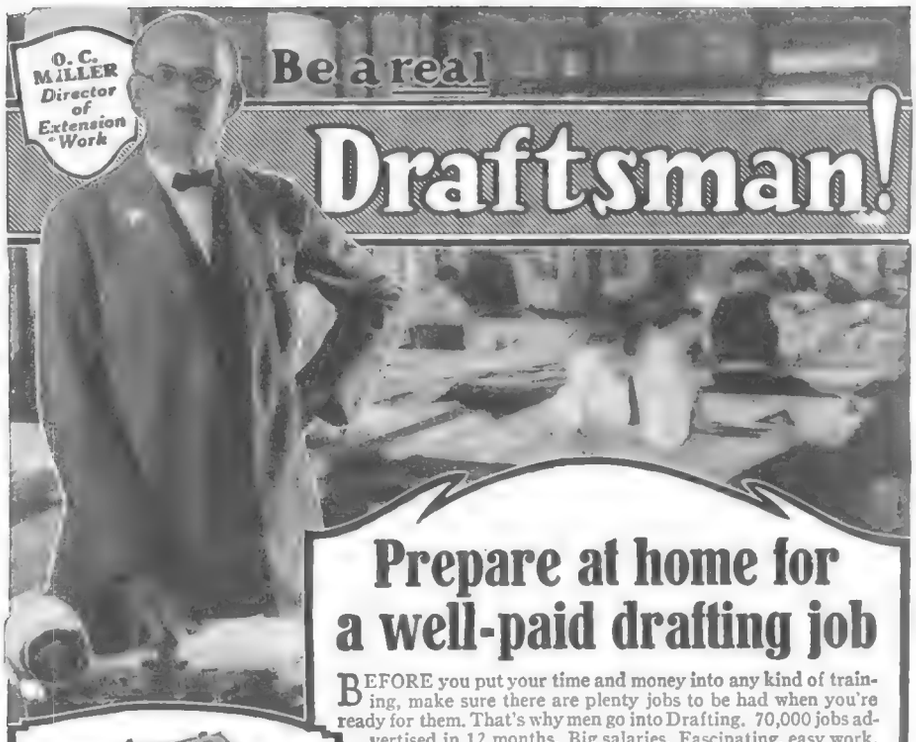

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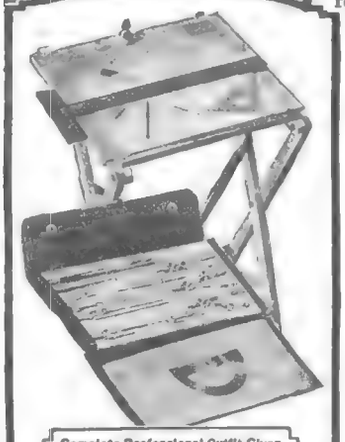

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The Home Set

By A. P. PECK

(*Continued from page 625*)

Be sure that the rotary plates of the variable condenser are connected as indicated. In all cases the rotary plates should connect with the filament circuit.

The potentiometer must be by-passed. Failure to include the condenser, C5, will render the results far from satisfactory.

The "C" battery voltage must be adjusted properly. The technical way of doing this is to use a low range milliameter in the plate circuit of the last audio frequency amplifier and adjust the "C" battery until the needle of the meter remains almost stationary when a fairly loud signal is being received.

Ground all the cases of the "B" battery eliminator as well as the cores and cases of the audio frequency amplifying transformer. This is accomplished by connecting all of these parts to the filament circuit.

Use only resin core solder on the joints of the switch, SJ. The use of acid or paste fluxes here may cause trouble.

Place the coils of the tuner in about the relative positions shown in the photographs. If they are placed parallel they will interact and cause trouble.

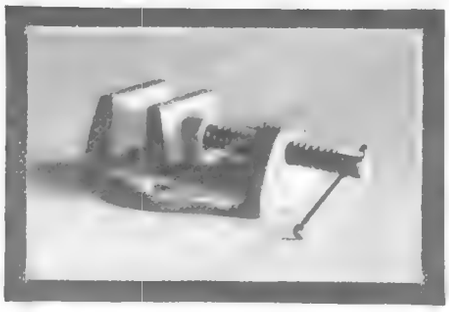
Use shock absorbing sockets if perfect freedom from microphonic noises is desired.

And that completes the description of an outfit wherein the radio set and "B" eliminator are combined. Do not worry that an increased hum will be produced by the proximity of the "B" eliminator apparatus to the set. If the precautions stated above are observed no such trouble will be found.

List of Parts used by the writer in "The Home Set":

C—.0001 mf. fixed condenser;
C1 & C2—.0005 mf. variable condensers;
C3—.00025 mf. variable condenser;
C4—.00025 mf. fixed condenser;
C5—1 mf. fixed condenser;
C6 & C7—.1 mf. fixed condensers;
C8—Filter condenser block;
L, L1, L2 & L3—Home-made tuning coils;
R—Potentiometer;
R1, R4 & R5—Self-adjusting resistances;
R2—Variable grid leak;
R3—Detector rheostat;
AFT1 & AFT2—Audio frequency transformers;
CB—4½- to 9-volt "C" battery;
SJ—Special switch;
1, 2, 3 & 4—Vacuum tube sockets;
SB—Double-pole, single-throw, pull-chain switch;
RS—Raytheon socket;
T—"B" eliminator transformer;
CH—Double choke grid;
R6—7,500-ohm resistor;
R7—5,000- to 50,000-ohm variable resistor;
R8—1,000- to 10,000-ohm variable resistor;
X—Standard porcelain lamp socket.
(Names of manufacturers of parts used by author furnished on request).

HANDY RADIO VISE



This strong yet small and convenient hand vise will prove very useful to radio constructors and the home mechanic in general. The price of the vise is low and it is particularly well adapted to the needs of those dabbling in mechanical and electrical work. Two securing holes are provided. Name of maker on request.

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MEAD Cycle Co., Dept. C-107 CHICAGO

Increasing Selectivity

By A. P. PECK

(*Continued from page 623*)

several inches away from the coil, and the hunt continued.

The particular console in use was one of the type incorporating a built-in loudspeaker. (See Fig. 1). In order to increase the length of the horn and so give it better acoustical properties, the manufacturer had curved the horn around and then projected the end of the horn upwards. The metal cased unit on the small end of the horn came near to the detector tuning coil of the particular set under discussion. Tests were made to determine whether or not one of the terminals of the loud-speaker was connected to the casing, but such was not found to be the case and probably will not be found in the majority of speaker-units. Therefore, a wire was connected to the casing of the unit and the other end of the wire was connected to the ground binding post of the receiver. Immediately results improved still further, and in fact with these changes the set was found to be amply selective for all practical purposes.

Remember the poet (or was it a poet?), who said, "It is the little things of life that count." In radio it is indeed the little things. If even the fixed condensers incorporated in the tuning circuit are not of good manufacture they may increase the radio-frequency resistance to a point where the tuning will be considerably broadened.

To Readers of

"THE EXPERIMENTER"

You will find the best features of THE EXPERIMENTER preserved in SCIENCE & INVENTION, besides a brand new "Model Department". See the beautiful Silver Trophy cup for best model each month described elsewhere in this issue.

Another point that must not be overlooked if tuning is to be kept at its best, is fixed or variable resistances sometimes incorporated in sets. If such a resistance is used anywhere in the tuning circuit for stabilization, try by-passing the resistance with a fixed condenser having a value of ½ to 1 mf. This condenser will provide a path for radio-frequency current around the resistance and will lower the effective resistance of the tuning circuit. Particularly is such a by-passing condenser of value in a circuit employing a potentiometer. Connect the condenser from the center post of the potentiometer to the side of the "A" battery which connects to the ground. (See Fig. 2). Then, and then only, will you realize the best possible results from a potentiometer controlled receiver.

In some types of radio sets where the antenna is connected directly to the first or antenna tuning coil, the antenna tuning dial will be broad. Try connecting a fixed condenser having a value in the neighborhood of .0001 mf. in series with the antenna as in Fig. 3. Such a connection tends to throw the effective wavelength of the antenna-ground circuit off resonance with the first vacuum tube circuit and to produce the effect of a semi-aperiodic antenna circuit. It will also prevent, to a very great extent, oscillation of the first tube circuit.

And there you have a working basis for trouble shooting on non-selective receivers. We have attempted to cover the majority of points that give rise to such trouble, and are sure that the reader will profit by remembering them and applying them to the next set that he works on or builds.

Handiest tool in your workshop

PERHAPS you have never thought of the special advantages of using LePage's Liquid Glue. It is always ready for immediate use. No weighing, soaking or heating is required. Its quality is always the same. It "sets" slowly enough so that you have plenty of time to place the joints together exactly as they should go. Slow setting also allows LePage's to penetrate the wood, increase the strength of the joint. LePage's Liquid Glue is equal in strength to any animal glue. Buy a can for your workshop. It is the easiest, quickest, handiest form of Glue. Insist on LePage's.

Recipe for making LePage's Gesso

TO MAKE one cup of LePage's Gesso, you will need 1 gill can of **LePage's Glue**, 1¼ cups whiting, 3 teaspoons linseed oil and 3 teaspoons varnish. Place whiting in mixing bowl and pour in slowly in this order, LePage's Glue, Linseed oil and varnish. Mix until smooth. All ingredients obtainable at nearest hardware store.

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NOW with the coming of the holiday, gift-making season, when the man who has a home workshop especially enjoys his hobby of making useful, practical gifts that can be used and appreciated by everyone in his home—come these two NEW LePage's Craft Books to show you how to make better Christmas Gifts and how to improve your craftsmanship. The titles of these two books are, "LePage's Practical Suggestions for the Home Workshop," and "LePage's Gesso-Craft Book."

Naturally when you tackle the making of an article like a breakfast nook, ship model or cedar chest, you want to come as near as possible to equalling the skill of the trained cabinet-maker. One of the things which he knows that you also must know is how to make strong joints—joints that combine strength with gracefulness and beauty. The only way to do this is with the use of glue, and this is exactly the information given you in these books. They tell you how to make strong joints with glue, and not only with glue, but with glue in its most convenient form—LePage's Liquid Glue.

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These books also show you how to cover up small defects in your craftsmanship. Now and then a tool will slip and an error is made. Or there are holes to be filled where nails or screws have been countersunk. Or the edges of a joint are not exactly even. A simple new way to repair these defects is with the use of LePage's Gesso instead of putty. LePage's Gesso will stick to any surface—wood, metal, glass, etc. It can be sandpapered, planed and painted or stained just like wood. We give you in the small panel below a simple formula for making LePage's Gesso, but of course we tell you more about it in the books themselves, together with practical information on decorating your finished articles with Gesso.

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THE practical and useful help of these two books is yours for only 10 cents. Just write your name and address on the coupon below, tear the coupon out and mail it to us today with 10 cents in coin or stamps, and we will at once send you a copy of these two LePage's Books, postage paid. Address LePage's Craft League, Dept. NN2, Gloucester, Mass. Tear out the coupon now so that you will not forget it.

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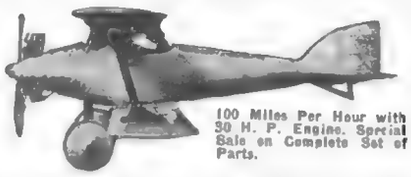

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Odd and Unusual Patents

By STUART WALKER

(*Continued from page* 589)

ground and is attached to a loud bell. This humane invention provides that a person upon coming to his senses in a highly disagreeable and dangerous position below the earth, need only to tug on the rope, ring the bell and summon help.

A cautious gentlemen from beyond the Mississippi secured a patent on anchors for houses. He provides houses with anchors in the form of blocks to be buried at each corner of the house. The purpose of these house anchors is very evident when the inventor points out that in a cyclone the anchored house stands safe and rigid, while the ordinary houses are blowing all over the landscape.

Mothers can readily understand the purpose of the fly chaser which has been patented. The patent provides for a baby carriage having a fan rotated by a belt attached to the wheels. As the carriage is rolled along, the fan is whirled about and the baby is kept free from annoying flies and other insects.

Other freakish patents which have been granted during the past hundred and fifty years of existence of our patent bureau cover: a mechanical cow milking device for milking one or more cows at the same time; a combination comprising a fish net and an umbrella; a mowing machine which is placed before the horse; a refrigerator hat, provided with a means for holding ice; designed to prevent sunstroke; an elaborate means for manufacturing artifical silk from spider webs and the like; an aerial railway suspended from live trees arched to hold the suspension rail; and umbrella made for people who suffer from chilly hands, having a heating attachment on the handle; a means for shaving with small grindstones which wear away the hair; a nose protector consisting of woolen pad attached to the nose in cold weather; a corpse hermetically sealed within a solid block of transparent glass; a means for guilding balloons by the use of strong birds, such as the eagle; a spanking device; a mirrowed fish bait; an elaborate means for preventing floods; a method of producing rain by artificial means, by the use of torpedoes attached to balloons and exploded among the clouds; and a motion picture trap for catching flies.

There is only one explanation, if one is necessary, to be given concerning the many strange and weird inventions which have been patented. It takes all kinds of people to make a world, and all kinds of inventors to make a patent office. And so the long and interesting list of curious patents continues to grow.

Home-made Toys for the Kiddies

Mr. William Butterfield, the well-known writer of our Home Mechanics Department, which does not appear this month owing to lack of space, will be with you again in the December number, with a very practical and clearly illustrated article with full details, describing how to build many attractive toys and amusement devices for the children.

$351.00 CLEARED IN ONE DAY

So writes W. H. Adams of Ohio. Letter from V. A. Marini of California reports $11275 sales in three months. Jacob Gordon of New Jersey $4000 profits in two months." Alexander of Pennsylvania "$3000 profits in four months." Ira Shook $368 sales in one day. Baum bought one outfit April 5 and 7 more by August 28. Iwata, bought one outfit and 10 more within a year. Mrs. Lane of Pittsburg says "sold 8000 packages in one day. J. R. Bert says "only thing I ever bought that equaled advertisement." John Culp says: "Everything going lovely. Crispette wrappers scattered all over town. It's good old world after all." Kellog, $700 ahead end of second week.

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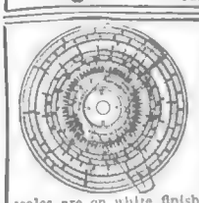

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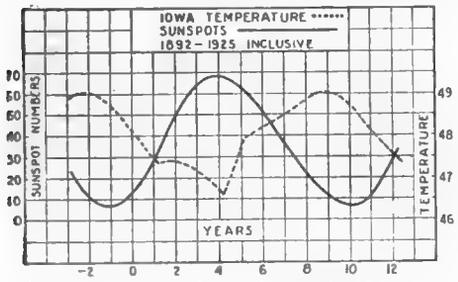
Sun Spots, the Weather and Crops

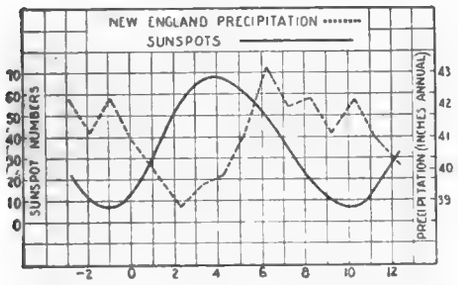
By CARRINGTON WOLFE, Ph.D.

(*Continued from page 609*)

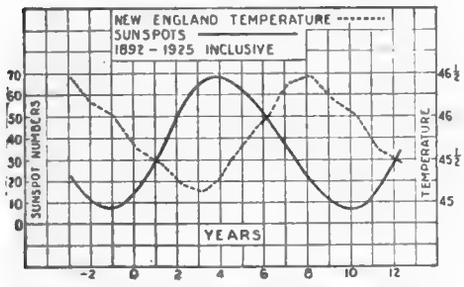
oats shows little or no relation. The average curve not following the sun spot curve at all, but following rather closely the average rainfall curve except that it reversed, that is, the best yield of oats occurs on the average in the drier years. These results on crops are for Iowa, and in another state the results might be different; but a twenty-year record furnished by the Illinois Experimental Station at Urbana indicates that in that state also the corn crop is best near sun spot minimum.



The curve above shows the relation between sun spot activity and Iowa temperature during the years of 1892 to 1925 inclusive.



The two curves above illustrate the relation between sun spot activity and precipitation or rainfall in New England over a period of years.



Above we see the relation of temperature in New England compared with the sun spot activity during the years of 1892-1925 inclusive.

EDISON MAKES 40-MINUTE RECORDS TO RIVAL RADIO

Charles Edison, son of Thomas A. Edison, who has just been made president of the Edison Industries, during a visit to Chicago, announced that to compete with the radio the phonograph industry would shortly offer a forty-minute record.

"My father has been working on the long-playing record for two years," he said. "It will play twenty minutes to each side.

"Long recital programs that formerly required an album of records may then be contained on a single disc," said Mr. Edison.

The phonograph industry, after having been almost wiped out by the automobile and radio crazes and the home building campaign, is coming into its own again, he said.

FURTHER AWARDS IN "BOARD" CONTEST WILL APPEAR IN AN EARLY NUMBER.

However storms may interfere with travel, telephone operators are at their posts

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AMERICANS rely upon quick communication and prove it by using the telephone seventy million times every twenty-four hours. In each case some one person of a hundred million has been called for by some other person and connected with him by means of telephone wires.

So commonly used is the telephone that it has come to be taken for granted. Like the air they breathe, people do not think of it except when in rare instances they feel the lack of it.

Imagine the seventeen million American telephones dumb, and the wires dead. Many of the every-day activities would be paralyzed. Mails, telegraphs and every means of communication and transportation would be overburdened. The streets and elevators would be crowded with messengers. Newspaper men, doctors, policemen, firemen and business men would find themselves facing conditions more difficult than those fifty years ago, before the telephone had been invented.

To prevent such a catastrophe is the daily work of three hundred thousand telephone men and women. To maintain an uninterrupted and dependable telephone service is the purpose of the Bell System and to that purpose all its energy and resources are devoted.

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Model Department

(*Continued from page 602*)

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.

2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.

3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.

4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.

5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.

6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the November contest must reach us on or before the 25th of August.

7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

THE UTILIZATION OF WIND POWER

According to *La Nature*, a form of windmill has been devised in France which is very different from those in use elsewhere, and much more efficient than the American and Dutch types. The new French type has only two blades, revolving in a circle 100 or 130 feet in diameter. M. Constantin, leader of a syndicate of engineers who have been studying the question of wind power since 1907, calculates that the hundred-foot mill in a 13-mile wind will give 50 horsepower, and the 130-foot mill will give 90 horse-power. With a wind of 22 miles an hour the smaller wheel will give 240 and the larger 400 horse-power. M. Constantin proposes to install a series of 130-foot windmills on Mont Ventoux, five thousand feet above the sea, and estimates that a single machine would deliver an average of over 700 horse-power throughout the year. The velocity at the extremity of the blades in the fastest wind would not be more than half that of the blades of an airplane propeller, so there would be no danger of their flying off. The wheel is to be connected directly with a dynamo to convert the rotary motion into electrical current and do away with gearing, cranks, or cables. The dynamo is encased in a light shell constructed on stream lines like a fish, so as to offer the least resistance to the wind. The wheel and dynamo turn on a common axis as the wind shifts.

A dozen or more such windmills are to be connected with an "aeolian central," where the varying currents will be brought together and transformed into a single current of constant intensity that goes out to the consumers. The surplus electricity at hours when the demand is slight is to be used in electric boilers for making steam, which may be stored for use as needed for heating or power.

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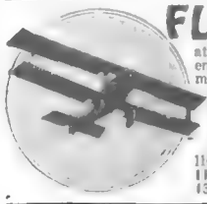

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The Window-Garden In Winter

By DR. ERNEST BADE

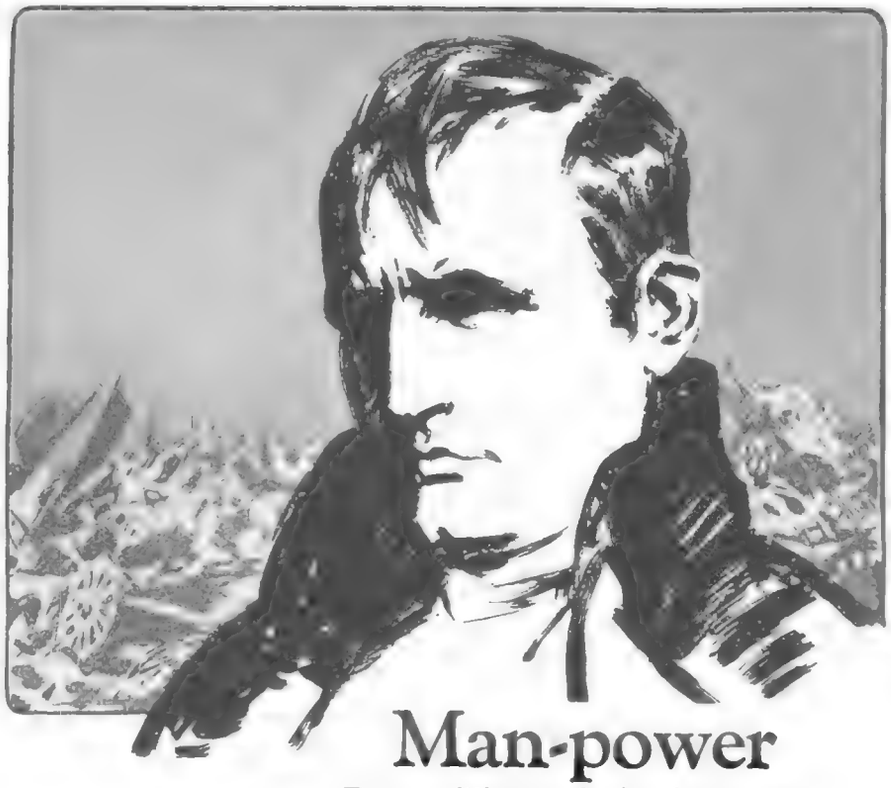
(*Continued from page* 592)

The Calla lily.

The Calla lily is another plant which produces charming flowers quite readily. This Calla (*Zantedeschia aethiopica*) is a native of Africa where it occurs in swampy locations. But this is not the only place where it may be grown. It adapts itself to almost any location, and in this respect it is one of the most peculiar plants. It is therefore no wonder that this plant is so universally appreciated, its flowers are showy, its form is beautiful and even its foliage is appealing. When it is cultivated in the living room during the winter, this plant will flower throughout the colder season of the year when properly cared for and correctly planted. But this is by no means a natural characteristic of the plant. It should be forced to take a period of rest lasting from June to October and this can be accomplished by simply lessening the quantity of moisture with which it is provided. After such a rest, the plant will develop less foliage and flower more profusely.

When the Calla is to flower during the

The Calla lily, a close-up of the flower.



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winter, the tuberous rhizome is placed in a pot provided with potsherds to facilitate drainage and containing a rich hotbed soil or garden soil. The pot is then placed in a cool location. November is the time that it is transferred to the warm living room, but the pot should not be placed where it receives heat, it should be left in a position where it is still comparatively cool. During the period of greatest growth, sufficient water can hardly be supplied, but it is not advisable to let the saucer in which the pot is placed, be continually full of water.

Freesia Refracta.

Liquid manure can also be given, this should consist of a solution of Chili saltpeter (nitrate). When the flowering season is over, which should not be later than June, and when the leaves are beginning to turn yellow, the Calla should be brought to the open and placed, with its pot, into the soil. It then requires no attention. During September or October, the tuber is removed, the soil taken from the roots, and rotted roots removed and the tuber again replanted in a larger pot. While transplanting, the new shoots are removed, for they weaken the plant. Propagation is carried out with these shoots or by the division of older stocks.

The yellow Calla (*Zantedeschia elliotiana*) is cultivated in a similar manner while the white spotted Calla (*Zantedeschia albomaculata*) looses its leaves in the fall. Their flat tubers must be kept dry and frost free over winter.

CORRECTION NOTICE

Due to an error the Simplified Safety Markers for directing automobile traffic, as described on page 502 of the October number, was incorrectly credited to the Wamblu Corp. This should have been the Wamblu Corp. Full name and address of manufacturers of devices described each month in SCIENCE AND INVENTION Magazine will be furnished on request.

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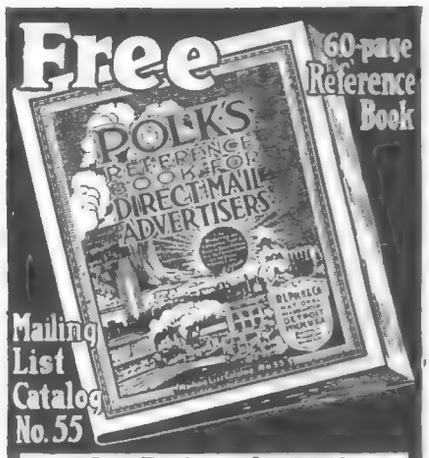

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Our Longest Railroad Tunnel

By H. WINFIELD SECOR

(*Continued from page 587*)

tunnel and railroad main heading proceed side by side with crosscuts connecting the tunnels about every 1,500 feet, as the exigencies of the work demand; but in the soft gneiss at West Portal the water tunnel is pushed ahead, crosscuts driven from it and main headings started in both directions from the crosscuts, in order that the maximum number of men may be attacking the headings which, for two crosscuts, might be four in number. The ventilating of the tunnel is accomplished by taking fresh air in through the water tunnel to blowers situated near the last crosscuts, and forcing it from that point through pipes to the headings under about four pounds pressure. By bulk-heading off the water tunnel, with swinging doors at the blower station, the smoke and gas from the headings is forced out through the crosscut and the main railroad tunnel, making it possible to return to the breast fifteen minutes after firing. Before being used for carrying water, parts of the smaller tunnel will be lined with concrete to prevent leakage through seams and seepage into the railroad tunnel.

There are two tunnel camps, one located on the western slope where 500 men are employed; the other on the eastern slope where 200 to 250 men are employed. These two camps are known as West Portal and East Portal. Each one has a post office and railroad station.

The Moffat Tunnel was started in September, 1923, when contract was let to Hitchcock and Tinkler, Inc., for its construction. The time set for its completion was 46 months. It is now six months ahead of schedule.

The elevation of James Peak is 13,260 feet. The tunnel goes under the north shoulder of the peak, the elevation of which is 12,000 feet. The tunnel elevation at East Portal is 9,198 feet; at West Portal 9,085 feet; at the apex 9,242 feet. The grade from East Portal to the apex is .3 per cent, and from West Portal to apex .8 per cent.

SIXTH LONGEST RAILROAD TUNNEL

When the Moffat Tunnel is completed it will be the longest railroad tunnel on the Western hemisphere and the sixth longest in the world. The railroad tunnels that will exceed it in length are in the Alps and the Austrian Tyrol. They are the Simplon, 12.4 miles; St. Gothard, 9.26 miles; Loetschberg, 9.3 miles; Mt. Cenis, 7.97 miles; Arlberg, 6.2 miles. New machinery has been invented or developed to meet the requirements of the job. A drill carriage on wheels which mounts four drills has been so devised that the set-up time has been cut from 40 to 15 minutes. With an electric mucking machine, a two-yard car can be loaded in two minutes. Another new machine is an air hoist for switching cars. One of the most important parts of the equipment that has proven almost indispensable at the west portal is the Lewis Traveling Cantilever Beam, designed by George Lewis, general manager of the commission. The device has not only speeded up operations, but absolutely holds the wall plates and arches in their true position while the bench is being excavated and the plumb posts set in place.

On January 6, 1926, the Moffat Tunnel Commission signed a contract with the Denver and Salt Lake Railway for the use of the railroad tunnel when completed. It is a 50 year contract with privilege of renewal for 40 years. The rental value of the railroad tunnel was set at an amount sufficient to pay interest upon and retire 66 2-3 per cent of the outstanding tunnel bonds. The rent of the water tunnel is to

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take care of the remaining 33 1-3 per cent. The railroad will pay an annual rental of $345,000 for the next 16 years, then pay from $536,740 down to $320,660 for the next 20 years and retire the last of the bonds with annual payments of $266,166 to $187,416 for the final ten years. Provision is also made for a $75,000 yearly upkeep and the running expenses of the district. Under the law there can be no exclusive use, and other railroads if they so desire may have the use of the tunnel on the same terms.

To appreciate the engineering features of the Moffat Tunnel it is necessary to know something of the operating difficulties "over the hill", as the train men refer to Rollins Pass. It has an elevation of 11,660 feet and two miles of snowsheds are maintained to enable trains to operate during the winter. Forty-one per cent of the operating cost of the Moffat railroad is in getting over "the hill", the difficulties of which will be avoided by the use of the tunnel, which will eliminate the four per cent grades that now are so expensive and difficult.

What are the results to be achieved by the opening of the Moffat Tunnel route besides those already mentioned? Mr. Gerald Hughes, writing in "Northwestern Colorado" has this to say:

"The results can be catalogued—immediate, affirmative, and direct. I believe there will be three; first, the opening up of the territories along the line of the railroad; second, a through, transcontinental railroad line to the Pacific coast, either by construction of the Dotsero cut-off, connecting the Moffat line with the Denver and Rio Grande Western, the construction of the extension through the Uintah Basin, or by both; third, water.

"First, the road today is carrying 1,000,000 tons of coal a year. It is not unreasonable to expect that this business may increase to 2,000,000 tons. Second, there is oil. A total of 5,700 barrels a day are produced now in Colorado. On the route of the Moffat road there are produced 2,900 barrels a day—more than half of all the oil produced in Colorado. There is going to be an increase. Third, there is agriculture and live stock. If my figures are correct, 1,500 carloads of lettuce, vegetables and live stock are shipped out on the Moffat road every season. It is reasonable to expect that there will be twice that next year. You will live to see it increased tenfold.

"As to the connecting link on a transcontinental road, both the Dotsero cut-off and the Uintah Basin extension are legitimate and will come. The Dotsero comes to mind first. It will be but forty miles long and can be built at a cost of $3,000,000 at a saving of 175 miles in distance and eliminating two divides between Denver and Salt Lake City. Fast freight and passenger trains are going to pass through Denver, linking up here with the Burlington and the Rock Island systems.

"I believe the Uintah project will some day be built, for several reasons: first, because it was the original aim of Mr. Moffat; second, because there is already traffic waiting there. There are 330,000 acres under ditch. It has 500,000 acres that can be cultivated—a kingdom in itself. In the Uintah Basin are 150 million tons of gilsonite and other minerals. The Uintah Basin is the most important territory still undeveloped in the United States today. Some day it will be developed.

"With the tunnel completed, there will be left 255 miles to build through the Uintah Basin to make the Moffat a through railroad line between Denver and Salt Lake City. That link built, and the railroad will be connected with railroads such as the Southern Pacific, Western Pacific, and Union Pacific, on the west, and on the east linked up with such lines as the Missouri Pacific, Union Pacific, Santa Fe, Burlington,

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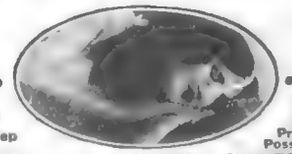

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Rock Island, radiating out from Denver. Denver will be the cross-roads of the country. We shall have, not only the east-and-west roads, but the north-and-south systems along the eastern base of the Rocky Mountains, from Texas to Wyoming.

"The Moffat tunnel was planned for water as well as for the railroad. The total supply that can be held in Cheesman reservoir is 79,000 acre-feet. Denver in 1924 consumed 67,000 acre-feet. The Moffat Tunnel will carry 100,000 acre-feet. It will open for the city in one year a greater water supply than the capacity of Cheesman reservoir. It has a value that has never been fully understood."

There is available from the western slope about 250,000 acre-feet in the average year, 100,000 feet of which can be brought through the Moffat Water Tunnel. Therein lies the key to the future of Denver. To bring water from the Fraser and other tributaries of the Colorado River through the water tunnel will require the construction of collection canals over thirty miles in length, which will deliver the water into the tunnel at sufficient height to force it through by gravity, the intake being well above the high points of the center of the tunnel. From the eastern portal the water will flow down the rocky canyon of the South Boulder Creek, with but small evaporation or seepage losses, to Eldorado Springs, where the plains meet the hills. From there it is but a short distance by conduit to Denver. It is also but a short distance to the head-gates of Irrigation District No. 2, where water users are in a position to trade their old right above Denver with the city for western slope water. In either case, when the water tunnel is completed, the low cost of the additional supply to Denver, offers an attractive investment.

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When SCIENCE AND INVENTION Magazine was still in its infancy, the editors denied the possibility of constructing a perpetual motion machine using those forces of nature as we now know them.

Since that time the editors have received thousands of different designs for perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.-00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

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Photos or sketches and short description all that editors require. For details see page 500, October number.

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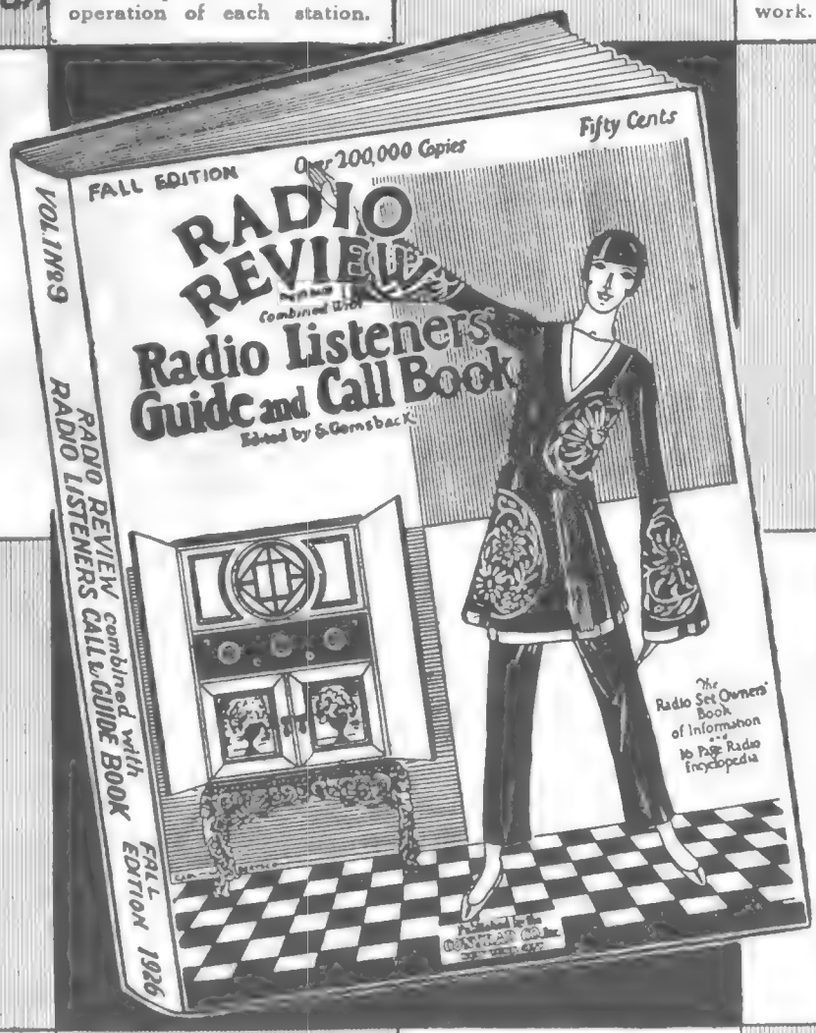
LATEST LIST REVISED WAVE LENGTHS

ALL CANADIAN BROADCAST STATIONS
(Listed two ways)

All Broadcast stations in Canada are listed in this section and in two different ways for the convenience of the reader. First, by call letters and second, by Provinces and cities. Like the listing of the U. S. Broadcast stations all details are given including ownership, power, Meter and Kilocycle wave-length, etc. This is a handy section for Fall D.X. work.

ALL FOREIGN BROADCAST STATIONS

Besides the U. S. and Canadian stations **Radio Review** contains the finest list obtainable of Foreign Broadcast stations including even such countries as Jugoslavia, Poland, India, Peru, etc., giving Ownership, Call letters, Wave Length and Power.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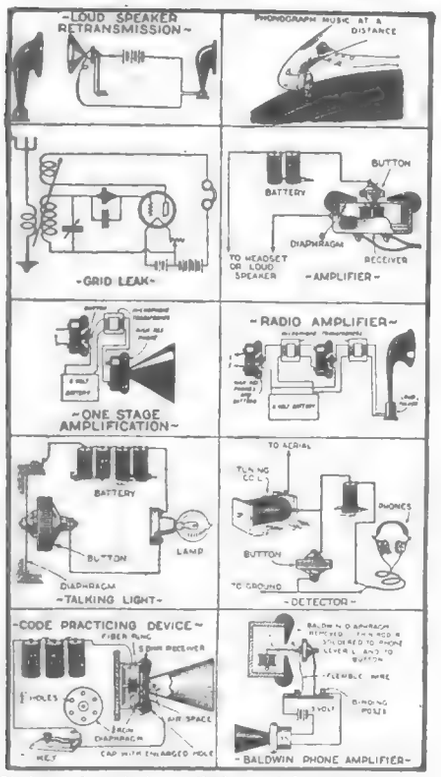

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By DUNNINGER

(*Continued from page 597*)

of this colored mystic. Slight breezes had been gradually finding their way thrugh the hot streets, so the walk was rather refreshing. I came to a short street of narrow, old-fashioned houses, showing clearly the marks of time, and which stood directly behind the railroad station. As I approached the number I was directed to, four or five colored people, who had been seated upon the veranda, which stood but a few feet away from a dilapidated gate, silently focused their eyes upon my approach, as if expecting me to speak. "Where will I find Mrs. Baxter, please?" I asked. A sweet-voiced elderly lady, whose black eyes shown brilliantly, accompanied by a contagious smile, spoke up quickly. "I am Mrs. Baxter, sir, she said. "What is it you wish?" I looked about at the darkies seated beside her, all of whom seemed motionless, and apparently accustomed to a number of mystery-seeking callers. They were quite undisturbed by my presence. Seeing that her spiritual business was therefore commonplace knowledge, I at once proceeded to explain that I had several questions I would like to ask her, as I understood she had been gifted with remarkable advice-giving ability. Her pleasing smile once more emphasized, and with pleasant voice, the tone of which none but a Southern negress could produce, she directed me in, assuring me that I had the proper party.

We entered a room slightly over the ground level. The two windows faced outward upon the veranda, where could be seen her small band of associates, who had previously accompanied her. With apologies for the heat in the room, she closed the windows, and drew the blinds, explaining that unnecessary noises from the outside would greatly confuse her, and best results were always obtained when absolute silence prevailed.

Her conversation, in businesslike fashion, at once drifted to a series of questions, as to my business, my whereabouts, but what seemed most important, who had sent me to her. It seems that the cross-examination met with her approval, as I was informed that she was willing to give me a sitting for $10. The lady at the hotel had casually remarked that her price was $5, so it seems that our medium was not entirely ignorant of the powers of psychology, as my appearance seemed to prompt a higher price, or was it perhaps that my spirits were at a greater distance, and therefore demanded a greater financial inspiration, to travel back to earth? A lamp had been dimly burning, the light of which was quickly brightened. Two more lamps of old-fashion type, were likewise lit. The room was of the usual style characteristic of the blacks of Georgia, save perhaps, for two stuffed figures, the one a cat, the other an owl, which peeked forth from beneath two glass dust-laden covers. A small table in the center of the room, held a tray upon which were several pieces of chalk, two or three slates, and a stack of books. A number of pictures adorned the walls, all, in most probability, members of the dear lady's family. Not that I was able to distinguish a likeness, but this assumed fact, not being of apparent importance, I accepted as true.

My medium moved a lone chair, in position, in front of the center table, and directed me to be seated. She now entered into a lengthy, almost scientific analysis of her work, and explained that I was to write the things I was interested in, upon one of the slates, place it before the stack of books,

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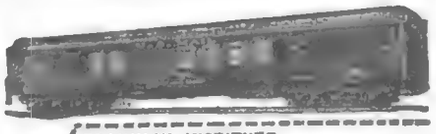

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and concentrate intensely upon my questions. She asked me to be sure to sign my name. In order to gain my confidence, she assured me that she would leave the room, while this writing was taking place, and after I had read it over several times, and concentrated thereupon, I was to place the slate, face downward upon the table, so that one could not see what I had written, and then call her back into the room.

Whether the dear lady did not care to enter into a financial speculation with me, or whether it was purely a part of her business system, I cannot say, but she insisted upon payment in full, before we began, and so, after I had sent one of the peelings of my roll into the land of the great beyond, this lady of mystic wisdom left me alone with my thoughts, and writing material. I wrote two questions:

The first, how much money have I in my pocket; the second, shall I continue or dissolve my business association with William T. Edwards. I merely signed my initials, J. D., to the questions. I placed them, as directed, close to the edge of the books, read them conscientiously, and then placed the slate, face downward, upon the table. I now called in Mrs. Baxter.

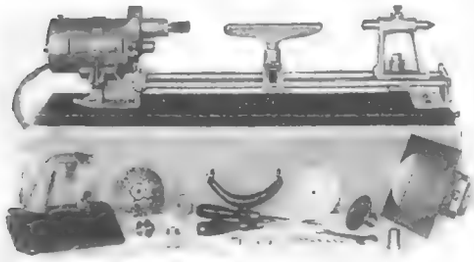
The stubby little woman seated herself in a seat at a corner of the room directly opposite, and went into a trance. For fully ten minutes, she spoke with the spirits, or through the influence of spirits, and then informed me, with reference to my first qusestion, that I had $10 less than when I entered. No attention was paid to my financial balance, however. She likewise described Mr. Edwards, as being dishonest, and advised me to dissolve partnership with the gentleman. My initials were also called. All this, bear in mind, dear reader, by the aid of the spirits.

Well . . . . as you probably have guessed, the Mr. Edwards that I referred to must truly have been in the spirit world, as I knew of no such person. Mrs. Baxter probably found his telephone number in her spirit directory. The trick that she employed to read my questions, was an exceptionally clever one. As I stood the slate erect, and re-read my questions, the little wonder-lady did likewise. She walked out of the room into another, where she opened a panel in the wall, directly in back of me. Standing over my shoulder, she read the slate, and all that it contained.

This panel was cleverly disguised, built in the form of a picture in a frame. Concentrating upon the written questions, a subject not ordinarily suspicious of what was going on behind him, especially when to his belief, he was alone in the room. I am frank to admit that the method she used was a good one, and I am not at all surprised to find that our medium has many followers. I am assured that in this land of cotton, there are many darkies who look upon Lady Baxter as a gift to mankind, from the land of the spirits. Illiterate, indeed, but a clever deceiver, and a real good business woman, was this medium from Georgia.

Radio Wrinkles Wanted!

The Radio Editor, Mr. J. Francis Clemenger, wants to hear from you, if you have a good idea or wrinkle. Make a pencil or pen and ink sketch of the contrivance, write 50 words or so of description, and mail to the Radio Editor, c/o this magazine.



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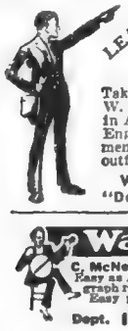

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Automatic Doctor and Health Meter

By HUGO GERNSBACK

(*Continued from page* 590)

urinary sediment, casts, etc. A recording hydrometer inside the machine registers the specific gravity of the urine before it flows into the respective tubes. The first indicator will show whether or not the urine is acid or alkaline. The second will record photographically on the health card the presence of albumin by the appearance of a ring. The third will demonstrate the presence of sugar in the urine, and the last will show up the casts, which if they are numerous, may be deposited in a small receptacle provided on the card.

THE HEALTH CARD

The health card itself will show the heart beat and a time record graduated in fifths of a second. Under this is an electro-cardiograph of a normal heart beat, and in the upper right hand corner a series of abnormal beats and what they signify. The patient can compare his heart beat with the abnormal beat and the normal beat to determine whether anything is wrong. The blood pressure chart gives the systolic and diastolic blood pressures, the straight line indicating the blood pressure of the patient, which straight line should fall within the unshaded area on the chart. If it falls above or below this, the patient should see a physician.

A chart of normal blood pressures at different ages will be found alongside of the patient's pressure indication. The body temperature is also recorded to the right of the blood pressure chart. Then we have an indication for the body weight, and another record of the height. To the right of the urine analysis photographic chart is found a printed group of specifications which will give the patient the opportunity of comparing his record with a normal record, and then statements might appear as follows. "The specific gravity of urine, if low, might cause one to believe that a interstitial nephritis was the patient's condition, and if high, that the patient had parenchymatous nephritis. The presence of a ring in A, which is characterized by a light colored area on the photographic paper would indicate albuminous material present in the urine, and this would cause one to presume that a nephritic condition was present. A perfectly white chart in C would indicate that sugar was present in the urine. The casts in the last tube should be carefully examined microscopically if any of the tests showed positive. If the specific gravity is normal, and there is no ring, and chart C is grayish or black, the casts need not be examined. It will be observed that the records of the test tubes are obtained photographically by lamps in back of the test tubes recording on the report card.

Motor Hints

By GEORGE A. LUERS

(*Continued from page* 611)

For checking up on the valves, remove the intake and exhaust pipes, by simply unbolting. Turning the engine over again by hand, the piston on compression stroke should neither blow through the intake or exhaust port.

If no appreciable escape of compression is heard at the piston or valves, the owner will find in nine times out of ten that the ignition is at fault or possibly something wrong with the carburetor.

(*Continued on page* 665)

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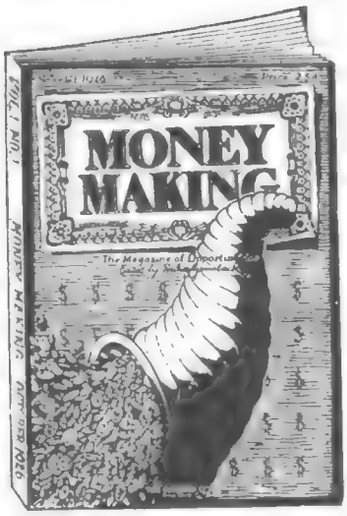
GOLD! —

from idle hours

"WE haven't all the same amount of money—*But,* we all have 24 hours a day—no less, no more. Many times the difference between financial success and failure is explained by the fact that the man who succeeded not only made use of every spare moment, but turned his regular working hours to his best advantage. Make it a point to watch some of your friends and business associates and note how many of them, claiming to be rushed to death, idle away hours that could be turned to good account. Also, be frank and courageous enough to watch yourself and see how you do the same thing."

You can't change others—but you can make your idle hours count.



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Motor Hints

(*Continued from page* 663)

CELLULOID AS WINTER REPAIR OF WINDOW IN CLOSED CAR

A window repair, the owner can make in a few minutes, good for several months of service or until the car can be put in for measuring and fitting a plate glass, is possible with celluloid.

The sketch shows this means of repair, for which a piece of sheet celluloid, sold for fabric side curtains is used.

To put in this piece, three screwed metal strips, at the sides and bottom of the opening, are removed. The sheet is then cut one inch longer than the opening and two inches wider, only a pair of scissors being needed for the work.

Clamp the strips over the edges of the celluloid, and screw down tight.

The Solidification of Helium

(*Continued from page* 593)

As an instance of the method of observing I mention the observations made at a temperature of 3.1° absolute, the pressure of the helium-bath being reduced to 20 cms. mercury. At 95 atmospheres pressure from the tube B, the tube system was cut off. So it was at 92, 90 and 88 atm. At 85 atm. the tube system was open. At 88 atm. it was closed again. At 86 atm. the galvanometer was deflected, then gradually returned to zero. We thus observed the helium melting.

Such were the experiments on June 25th. On July 1st I repeated these experiments with precautions for making more accurate observations. I took up the melting curve from 1.1° absolute to 4.2° absolute, corresponding to pressures from 25 to 140 atmospheres.

As the pressures necessary to solidify helium had appeared not to be so excessively high as we had expected, we now proceeded to solidify helium in a glass tube, F. Helium was compressed in it through the stopcock, K5. To see whether the helium solidified, we had provided within the tube a piece of iron H, forming an electromagnetic stirrer, such as was used by Kuenen for the first time. J was a cylindrical iron mantle which was made magnetic by an electric current in the coil N. By pulling the cylinder mantle J up and down, the stirrer H moved up and down, as long as the helium was liquid. When helium solidified the stirrer stuck fast. In these experiments the observations made in the metal tube were quite confirmed. Helium appeared to solidify as a homogeneous transparent mass.

A Tidal Ice Dam

(*Continued from page* 585)

ciently firmly to the bed of the sea and if it would be possible to make walls strong enough and to maintain them for a long period of time. The first experiments have abolished these doubts. After only a three-hour treatment with liquid air the ice dam held its position on the bottom for over six days and then only gradually melted away, although the temperature of the water during this time averaged six to eight degrees C. (43 to 47 degrees F). The imperiousness of the ice lasted for three to four days. Dread on the other hand of climatic changes due to the mass of ice can be put aside.—Edward Meier in *Die Woche.*

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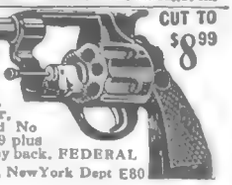

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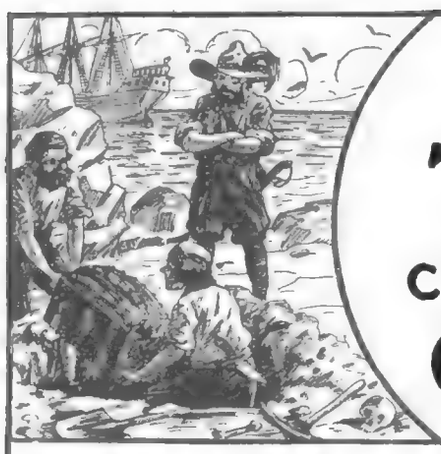
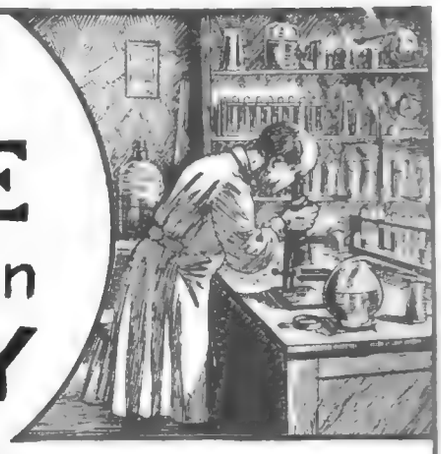


BURIED TREASURE can still be found in CHEMISTRY



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Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They *are* done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $40,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

What Some of Our Students Say of This Course:

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co. testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.—MORLAIS COUZENS.

I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORKUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

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I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMDAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas, Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.

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The Astrology Humbug

By JOSEPH H. KRAUS

(*Continued from page* 596)

this case? Also before entering upon the subject of the horoscopes, we would state that this one was not made up by an ordinary astrologer but by a woman who has a reputation as an astrologer and who because of that reputation charges $25.00 for an *ordinary* horoscope. Our first letter to Mrs. Doris K. Griffis follows:

August 12, 1926.

Mrs. Doris K. Griffis,
Dear Mrs. Griffis:

In confirmation of my conversation with your secretary yesterday afternoon, I enclose twenty-five dollars ($25.00) for a written horoscope.

Date of birth, Jan. 27, 1859.

Please forward horoscope to above address at once, as I expect to leave for Europe next week.

Very truly yours,
FREDK. W. VICTOR.

To this letter we received the following answer:

My dear Mr. Victor:

I have been trying to get you by phone—let me know at once your hour and place of birth, and if that is not possible, send pictures or describe yourself, giving all details as near as possible and ask me quantities of questions about what you want to know, and give me dates of anyone else who touches your life in a business or friendly way. Tell me if you are married, unmarried or about to commit matrimony, children or not, etc., etc. I never read for anyone by mail who can not come to me, but since you are going abroad I will—only you would have no satisfaction at all in the delineation unless you got what information you want—unless you wish only the position of all your planets in the signs, which is all any astrologer can tell you without your hour of birth. You will do much better if you see me personally first for a half hour or even fifteen minutes before I write it for you.

But I will do whatever you wish.

Sincerely,
KEVAH DEO GRIFFIS.

45 East 58
August 14th.

We answered this letter on August 16 as follows and please note the marked detail and information which this letter gives. Also remember that several books on astrology give us a complete horoscope of Kaiser Wilhelm.

August 16, 1926.

Mrs. Doris K. Griffis,
Dear Mrs. Griffis:

Your letter received. I enclose information as you request.

Approximate hour of birth, 3.00 P. M., near Berlin, Germany.

My wife now deceased. Married 1881.

My eldest son, born 1882, one of seven children.

My boat leaves Wednesday, so I must ask you to send my horoscope special delivery. I am naturally pressed for time, please pardon my impatience.

Very truly yours,
FREDK. W. VICTOR.

To this we received an analysis and also the communication which we reproduce.

(This analysis is based on tables in I. M. Pagan's "Pioneer to Poet.") Kevah Deo Griffis, 45 East 58th St., New York City.

HOROSCOPE OF F. W. V.

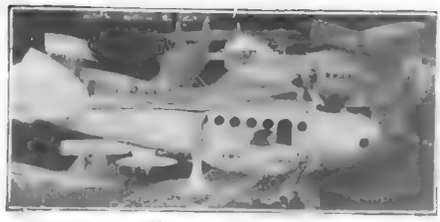
The Sun is the Ego—the central fire—its influence increases steadily with advancing years.

The Moon is the personality, lunar influence strong in childhood. Decreases steadily. Sun in aquarius in 8th house.

Those born when the Sun is in aquarius should find success in the sphere of the observer or recorder of phenomena (*If he had been it might have been better.—Ed.*)—The Truthseeker—and will probably engage in work which definitely alters their own outlook on life, and possibly also enlarges the sympathies and the mental horizon of great numbers of their fellow citizens of the world. (*He did—and so did the citizens after the war.—Ed.*) The driving force of the sign is the desire and craving for enlightenment, a passion for knowledge (*He got both—but not the way he expected.—Ed.*) and especially for knowledge of the occult or hidden truth which underlies the mystery of manifestation. This is often associated with a tendency to reject all incomplete and approximate statements which veil or distort the truth—a tendency which may be perverted into a depressed and depressing agnosticism.

INFLUENCE OF THE MOON

The Moon in Scorpio gives the habit of con-



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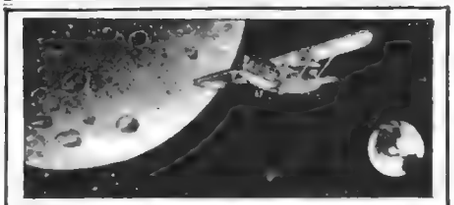

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centrating thoroughly on the task of the moment, but this position is often associated with narrow and limited views concerning life and work (*in previous horoscopes he has a craving for enlightenment and a passion for knowledge—this does not agree.—Ed.*) and it consequently is something of a handicap excepting for the very highly developed.

THE ASCENDANT

Cancer as ascendant suggests attainment through teaching or preaching or public speaking or through Fatherhood or its equivalent—the guardianship of the helpless, the ignorant or the infirm—work which requires endless patience, tenderness, adaptability and tenacity of purpose.—*well, well.—Ed.*)

THE ZENITH

Pisces at the Zenith gives aspirations for true insight or clearness of vision (*I thought she said narrow-limited views.—Ed.*) unclouded by illusion. (*How about his illusion of world prussianism.—Ed.*) and an ambition to interpret such vision in some way that will bring humanity nearer to the heart of the universe. (*It did.—Ed.*). The point of view is that of the poet, the mystic, the Seer.

THE NADIR

Virgo at the Nadir suggests as the basis of character that instinct for health and purity which leads to upright dealings and makes a man shrink from all that is morbid, hysterical and unclean.

During childhood the ascendant is dominant.
During youth the zenith.
During prime the descendant, in age, the nadir.

ASCENDANT—Cancer
Ruler:—The Moon in Scorpio.
DESCRIPTION
According to the Position of Signs
(Outer Personality)
WATCHWORDS—Sympathy and Power
TYPE—Parental and Scientific
METHOD—Effective, Analytical, Destructive
STYLE—Metaphorical, Trenchant and Cutting
INTELLECT—Retentive and Profound though Narrow
SPEECH—Picturesque, Significant, Fluent
MANNER—Dignified and Stately
BEARING—Self-reliant and Unassuming
TEMPERAMENT—Intense, Reserved, Secretive.
(Modified by the Position of the Planets)
FUNCTIONS—Poet or Interpreter and Truth-seeker and Scientist
OUTLOOK—Romantic—Settled—Limited
NATURE—Plastic and Simple and Sincere
AFFECTIONS—Adoring and Honest
ATTITUDE—Peaceable and Again Peaceable—(*Need we say more.—Ed.*)
SEX-ATTITUDE—Reverent and Shy
DISPOSITION—Unworldly, Lavish, Spendthrift.
DESCENDANT—Capricorn
MIND—Concentrative and Fertile
Capricorn descending suggests the type of mind which is concentrative and profound, somewhat bigoted.
NADIR—Virgo
CHARACTER—Upright and Merciful
KEYNOTES—Purity and Truth

45 East 58
New York
Aug. 17th.

My dear Mr. Victor:

You have a most extraordinary chart—you are the Kaiser's double. I have written out for you my usual form, and I will continue by correspondence. You see, or rather you would have seen, had you talked with me, that I do not read astrology in the usual way. I could write you reams of glittering generalities—any astrologer could—of any date given them. (*Why say—? Ed.*) No one wants that, they want definite answers to definite questions. You have the nativity of a man who has been interested in all forms of occult investigation and who knows too much himself to want any of the ordinary stuff. Tell me what you *want* to know, and I will gladly continue by correspondence, since you are too hurried to talk with me. This is the only way I work. I have given you a condensed chart; I can tell you of transits and progressions. *What do you really want to know?* I want to give you your real desire. You must be as frank and confidential as a patient with his doctor, or you can get no help—that is law—you must know that. Astrologers can only give what they get out of books, out of life, out of their own Cosmos, out of their intuition.

For 1926 you are commencing a new cycle, a change in your affairs—the natal Venus has progressed to a square of Uranus, and Uranus by transit in the sky is sextiling its natal place. The sun has progressed into Aries, making a friendly sextile to the natal and progressed Jupiter. The moon is transiting through the pioneering aries and will reach a square of Saturn at your next birthday. There are disappointments and delays in what you started to do this year, but 1928 brings fruition—(1927 is a *fallow* year—guard your health.) Unexpectedly helpful developments and much success—Uranus will be friendly to your natal Sun—to Saturn and to Jupiter. You have new life, new ambitions, very favorable conditions for all that you wish to accomplish. It will b

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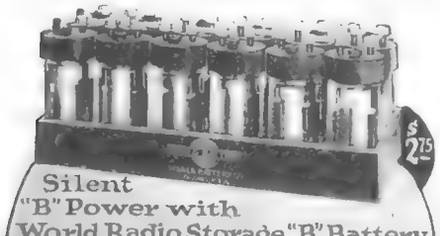

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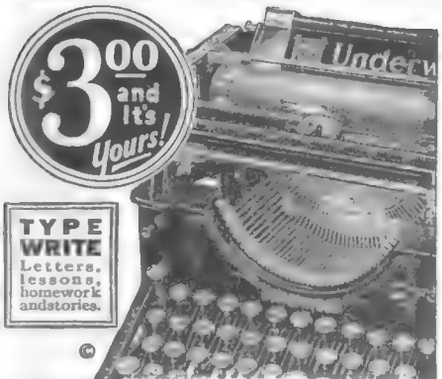

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one of the most thrilling and romantic and stimulating periods of your life, for not only is the great epoch-making Uranus friendly to such important planets as the Sun, Saturn and Jupiter, but the Sun sextiles the progressive Jupiter exactly, and the *Moon* is approaching a conjunction of Uranus and later transits Jupiter.

1926 has been a creative year when you would have found it easy to strike out along broader lines than you have been able to in recent years, to initiate new ventures and to take the lead in any association. The year marks a beginning.

September—the whole month is a supreme opportunity for you to establish new conditions. Do not look back on the past but face the future with all the courage and self-confidence of which you are capable. Much will depend on this month upon how you take the initiative. Create for yourself the position you feel you are ready for, and then stand firm on your convictions.

There is a difficult transit of Mars through the sign Taurus, now, and all the coming months, up into March of 1927, which is inimical to health—especially affecting the heart and circulation, and a difficult transit of Saturn over your Moon which is also dangerous for your own health, causing sexual troubles, depression of spirits, danger of death to a woman or a child in your life. Do everything possible in the way of diet, sleep and exercise in October and November, encourage free elimination, eat simple, laxative foods—breathe deeply, etc.—all the health rules—it promises trouble in your household and family, and perhaps the passing out of your life of a woman near to you. It is a bad time for marriage, love or pleasure.

Now if you care to tell me more freely of yourself—your profession, your loves and desires and ambitions, and will ask me further questions, I will be glad to continue, as the initial charge covers a month's correspondence and a further detailed forecast.

Sincerely,
(Signed) KEVAH DEO GRIFFIS.

And this, gentle readers is the horoscope of Kaiser Wilhelm. Now you will have noted that Mrs. Griffis requested us to ask her questions. She wanted to know what we really wanted to know and she wanted us to be as confidential with her as a patient with his doctor. By her own admission she could write "reams of glittering generalities." She could give us plenty of information out of her own intuition. Can the Kaiser ever hope to be able to strike out along broader lines than those he held during the years of the World War when it seemed that Europe would fall under his domain? If this year marks the beginning, what did 1914 mark?

We have stated that astrology is a humbug, that it is piffle, that there is nothing scientific about it and the more horoscopes we read, the stronger is our conviction. The publishers of this magazine are of the opinion that there is nothing in astrology and have published an award of $6,000.00 for proofs of astrology. Any astrologer who will be able to live up to the conditions outlined in the contest will be paid the prize moneys outlined and the astrologer need not necessarily be a professional. Several of our readers have written in that the examples cited in our last article do not prove that astrology is a humbug, but that the astrologers who drew up the horoscopes did not know their business. The astrologer who drew up the last horoscope is one of the best known in this country.

Were we to ask you how much 2 multiplied by 2 is, would you say that it is 9? If you gave the astrologer the facts and his work was scientific, should he not arrive at a definite conclusion which would be identical with other results obtained for the same date and place by other astrologers? Yet the results rarely correspond. This is not so with mathematics and a school boy on the West Coast will give the same answer to the simple multiplication problem above outlined as another boy residing in England.

We paid $25.00 for this horoscope. We could have paid more and received a worse letter and we could also have paid less and perhaps obtained a communication from an astrologer who saw that we were trying to trick him.

Read the letters again. We need not tell you that they are bombast. The letters speak for themselves.

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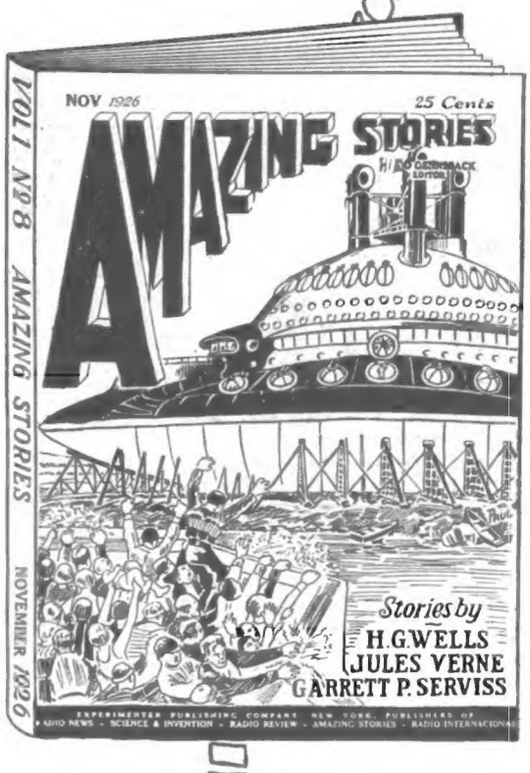

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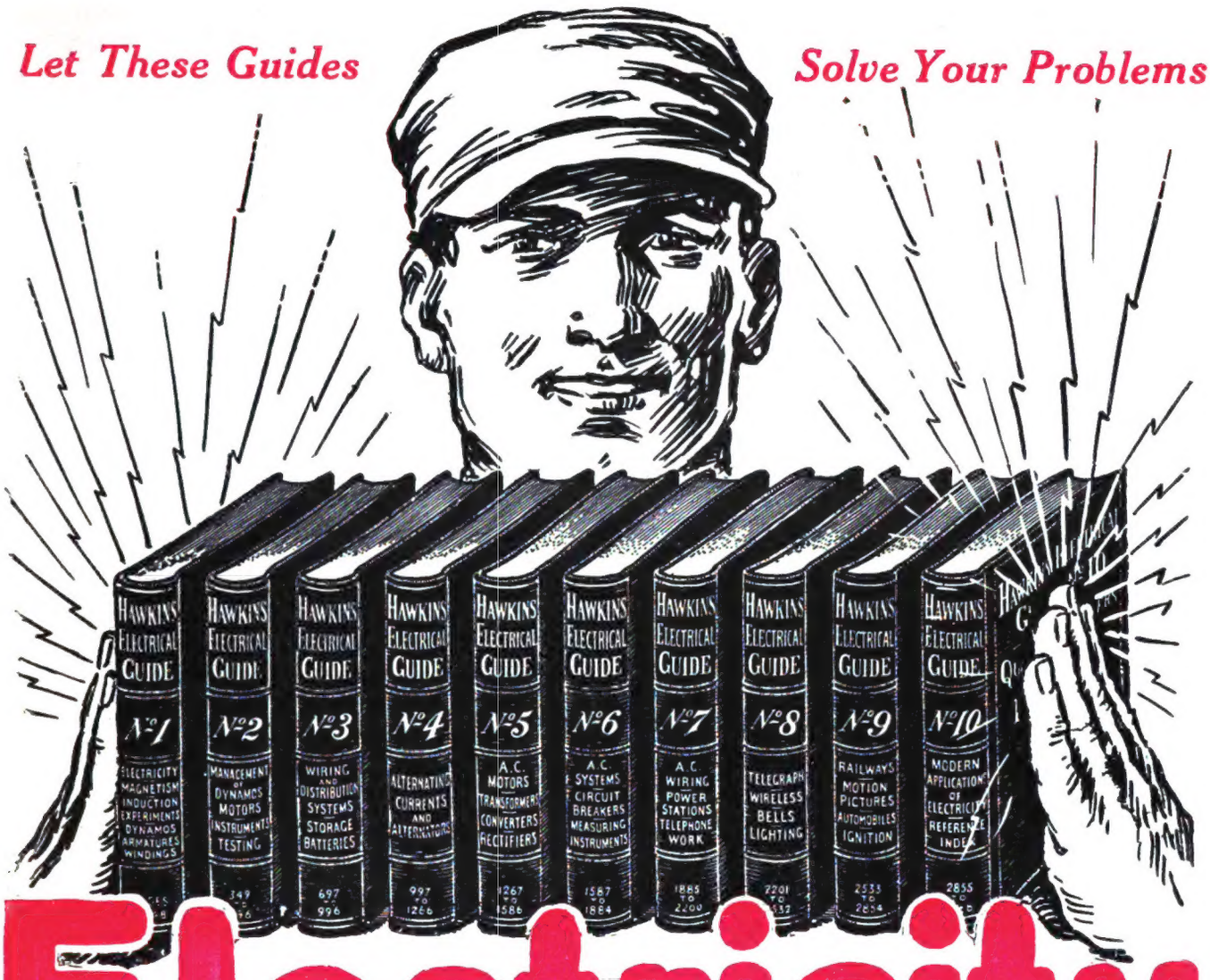

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"His Tail Between His Legs"

What most men would see if they could see themselves

MOST men are being whipped every day in the battle of life. Many have already reached the stage where they have **THEIR TAILS BETWEEN THEIR LEGS.**

They are afraid of everything and everybody. They live in a constant fear of being deprived of the pitiful existence they are leading. Vaguely they hope for **SOMETHING TO TURN UP** that will make them unafraid, courageous, independent.

While they hope vainly, they drift along, with no definite purpose, no definite plan, nothing ahead of them but old age. The scourgings of life do not help such men. In fact, the more lashes they receive at the hands of fate, the more **COWED** they become.

What becomes of these men? They are the wage slaves. They are the "little-business" slaves, the millions of clerks, storekeepers, bookkeepers, laborers, assistants, secretaries, salesmen. They are the millions who work and sweat and—**MAKE OTHERS RICH AND HAPPY!**

The pity of it is, nothing can **SHAKE THEM** out of their complacency. Nothing can stir them out of the mental rut into which they have sunk.

Their wives, too, quickly lose ambition and become slaves—slaves to their kitchens, slaves to their children, slaves to their husbands—slaves to their homes. And with such examples before them, what hope is there for their children **BUT TO GROW UP INTO SLAVERY.**

Some men, however, after years of cringing, turn on life. They **CHALLENGE** the whipper. They discover, perhaps to their own surprise, that it isn't so difficult as they imagined, **TO SET A HIGH GOAL**—and reach it! Only a few try—it is true—but that makes it easier for those who **DO** try.

The rest quit. They show a yellow streak as broad as their backs. They are through—and in their hearts they know it. Not that they are beyond help, but that they have acknowledged defeat, laid down their arms, stopped using their heads, and have simply said to life, "Now do with me as you will."

What about **YOU?** Are you ready to admit that you are through? Are you content to sit back and wait for something to turn up? Have you shown a yellow streak in **YOUR** Battle of Life? Are you satisfied to keep your wife and children—and yourself—enslaved? **ARE YOU AFRAID OF LIFE?**

Success is a simple thing to acquire when you know its formula. The first ingredient is a grain of **COURAGE.** The second is a dash of **AMBITION.** The third is an ounce of **MENTAL EFFORT.** Mix the whole with your God-given faculties and no power on earth can keep you from your desires, be they what they may.

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